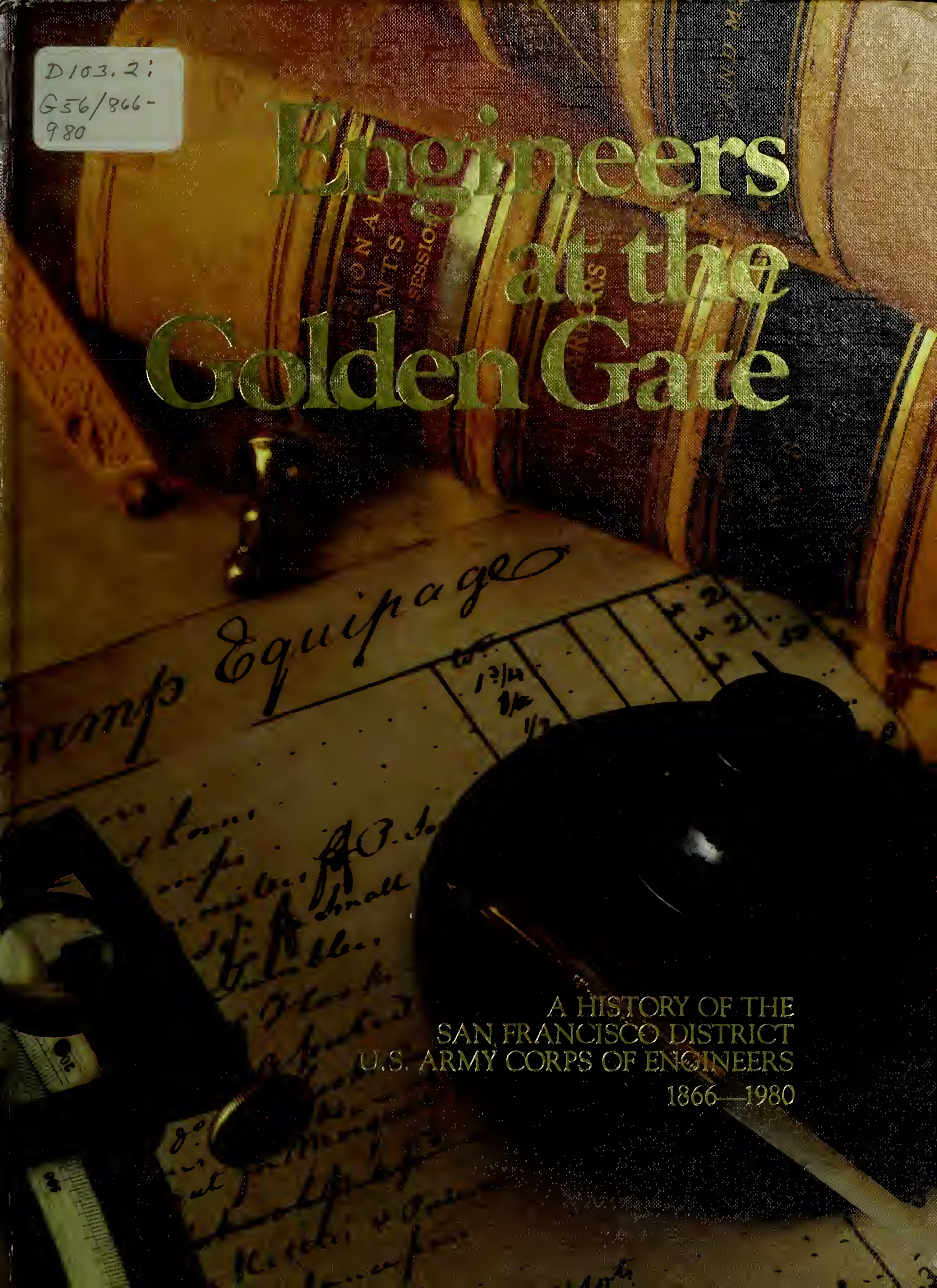

Engineers at the Golden Gate

A HISTORY OF THE
SAN FRANCISCO DISTRICT
U.S. ARMY CORPS OF ENGINEERS
1866—1980

To this Gate, I gave the name Chrysopylae, or Golden Gate, for the same reasons that the harbor of Byzantium was named Chrysolceras, or Golden Horn.

—John C. Fremont

Joseph Jeremiah Hagwood, Jr.
Historian

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Engineers at the Golden Gate

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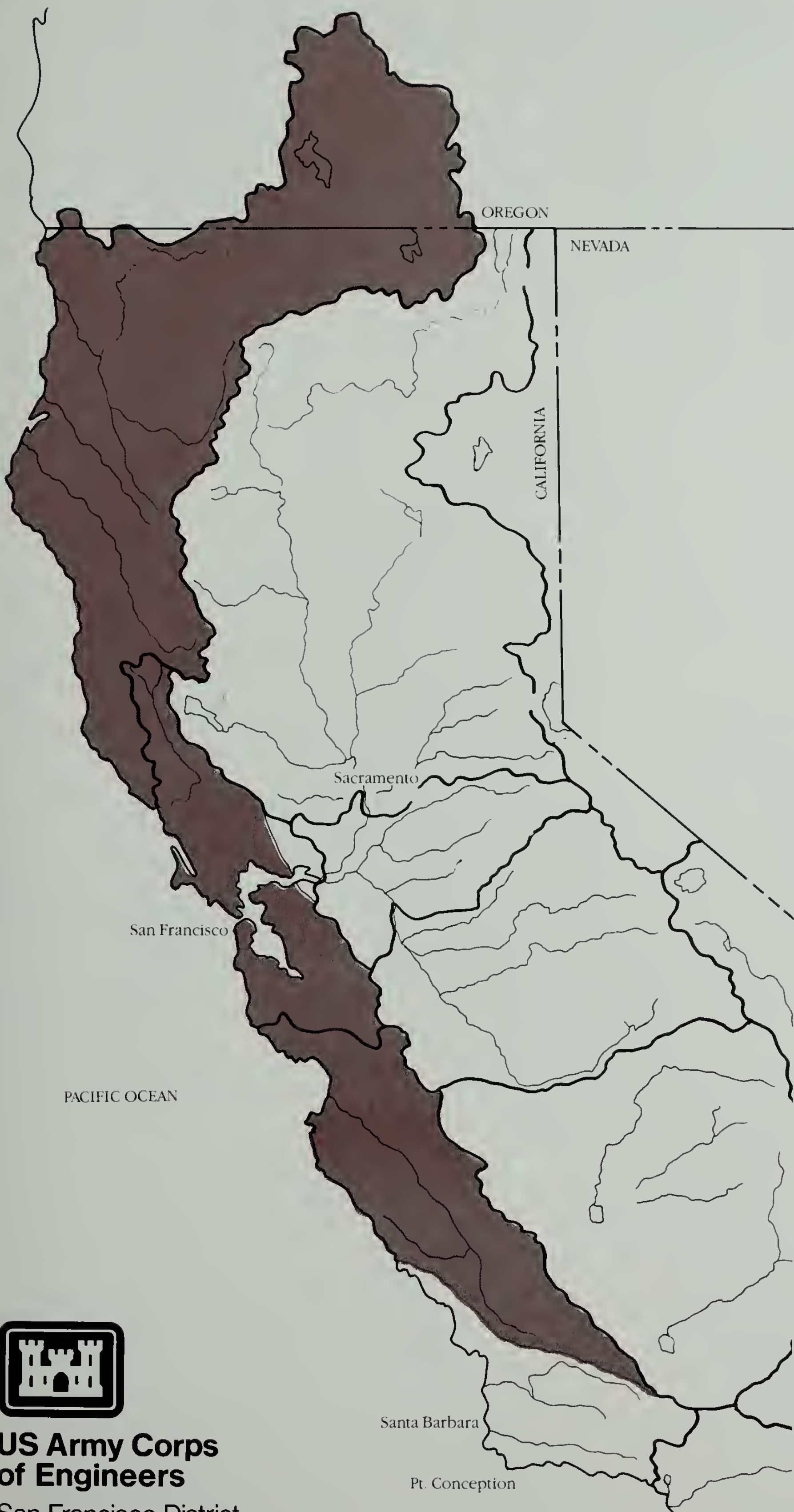

US Army Corps of Engineers
San Francisco District

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Preface

The San Francisco District was established in 1866 when Major R.S. Williamson was designated "Officer-in-Charge" with authority for river and harbor work on the Pacific Coast. With Lieutenant William H. Heuer to assist him, Williamson, from his office in San Francisco, had engineering responsibility for the entire Pacific Coast area west of the Rocky Mountains. The "district" extended from Canada on the north to Mexico in the south and to the Hawaiian islands to the west.

As the western states grew and developed, various new Engineer districts were created to meet local needs. The first of these was Portland District in 1871. That same year Major George H. Mendell assumed command at San Francisco.

In 1888 the United States was divided into five Engineer divisions. The Far West was thereafter known as the Pacific Division. Mendell was elevated to the rank of lieutenant colonel and placed in command of the Division, while maintaining effective control of the San Francisco District. This organizational structure—that is, the Division Engineer serving as both Division and San Francisco District Engineer—would continue until January of 1925.

Colonel Mendell retired in October 1895. For the brief period from Mendell's retirement to January 1896, the District and Division were in the charge of Captain Joseph E. Kuhn. Colonel Charles R. Suter assumed command in February 1896 and exercised authority until succeeded by Lieutenant Colonel William H. Heuer in 1901. Meanwhile, districts were created at Seattle in 1896 and Los Angeles in 1898. Then in 1901, the Pacific Division itself was split into two parts—the North Pacific Division and the South Pacific Division.

In 1905 a separate district was established at Honolulu. Just two years later in 1907, the San Francisco District was divided into two separate entities—the First San Francisco District and the Second San Francisco District. From that time until 1925, the District Engineer of the First San Francisco District would also serve as the Division Engineer of the South Pacific Division.

The First San Francisco District encompassed the coastal area ranging from the California/Oregon border on the north to Cape San Martin near San Luis Obispo on the south. The Second San Francisco District was made up of the Great Central Valley of California. Finally, the Second San Francisco District was re-named the Sacramento District in 1929.

Today the San Francisco District comprises a long narrow strip of land, extending along the California coast from Point Saint George, just south of the Oregon/California border, to Cape San Martin, a point of land pushing out into the Pacific Ocean in the Big Sur country of the south-central coastal region. It is with that limited area that this brief study deals.

No project of this kind can reach fruition without the assistance and patience of many individuals. The San Francisco District personnel were especially helpful. Colonel John M. Adsit, District Engineer, set the positive tone for the work. The Historical Program Committee, chaired by Reva Maxwell, Chief, Public Affairs Office, was especially helpful and instructive. Mrs. Maxwell also served as editor, in addition to coordinating the design and printing of the book. Appreciation is extended to Michael Keuss, for his expert assistance in a number of areas, and to Marlene Wade, Public Affairs Office, secretary, and Sal Polito, District photographer, for their many kindnesses.

District personnel in positions of authority, by sharing their experience, enriched the history to a significant degree. These included Henry Pape, Chief of Engineering; Gene Dunn, Chief of Civil Design; Bill Angeloni, Chief of Operations Branch; Gerry Trail, Chief of Program Planning; Jim Wolfe, Chief of Construction-Operations; and Frank Scarpace, Comptroller.

Special mention must also be accorded several retired employees who responded generously to requests for information. These include Ludwig Kiramidjian, William A. Angeloni, Oswald Pietsch and James A. Fox.

A considerable debt of gratitude must also be recognized to John T. Greenwood, Chief, Historical Division, Office, Chief of Engineers. Without Doctor Greenwood's special knowledge of archival sources, the history would lack much important information.

Special thanks also are extended to the staff of the Federal Archives and Records Center, San Bruno, California, for it was they who found and supplied many of the original documents used in the study.

A word of appreciation must, as well, be given to the staff of the Plumas County Library, Quincy, California, for locating specialized studies dealing with the economy and the environment of coastal California.

The raw manuscript was typed by a pair of superb secretaries, Tami Fulton and Martha Taborski. To them I extend a sincere thank you for a job well done.

Finally, very special thanks are accorded my wife Gretchen, and my sons Gregory and Scott, for their encouragement and understanding throughout this effort.

Joseph J. Hagwood, Jr.
Quincy, California
1980

Foreword

This history represents the first comprehensive written and pictorial record of the Corps of Engineers in northern California and the San Francisco Bay Area. Since the early days of the Gold Rush, Army engineers have played an integral part in the mammoth task of opening up the west and developing its vital water resources.

The story describes how progress has been achieved mainly through the Army engineers developing working relationships with local governing officials, community groups and private citizens. This same spirit of cooperation has continued to our present day activities.

Although the Corps' mission and responsibilities have greatly increased to keep pace with the water-oriented needs of expanding metropolitan and rural community areas, we have also continued our role as chief stewards of this area's coastline, its ports, harbors and rivers. The district maintains the navigation channels, develops water and energy resources and improves flood plain management while preserving the natural environment and cultural heritages, and increasing recreational opportunities.

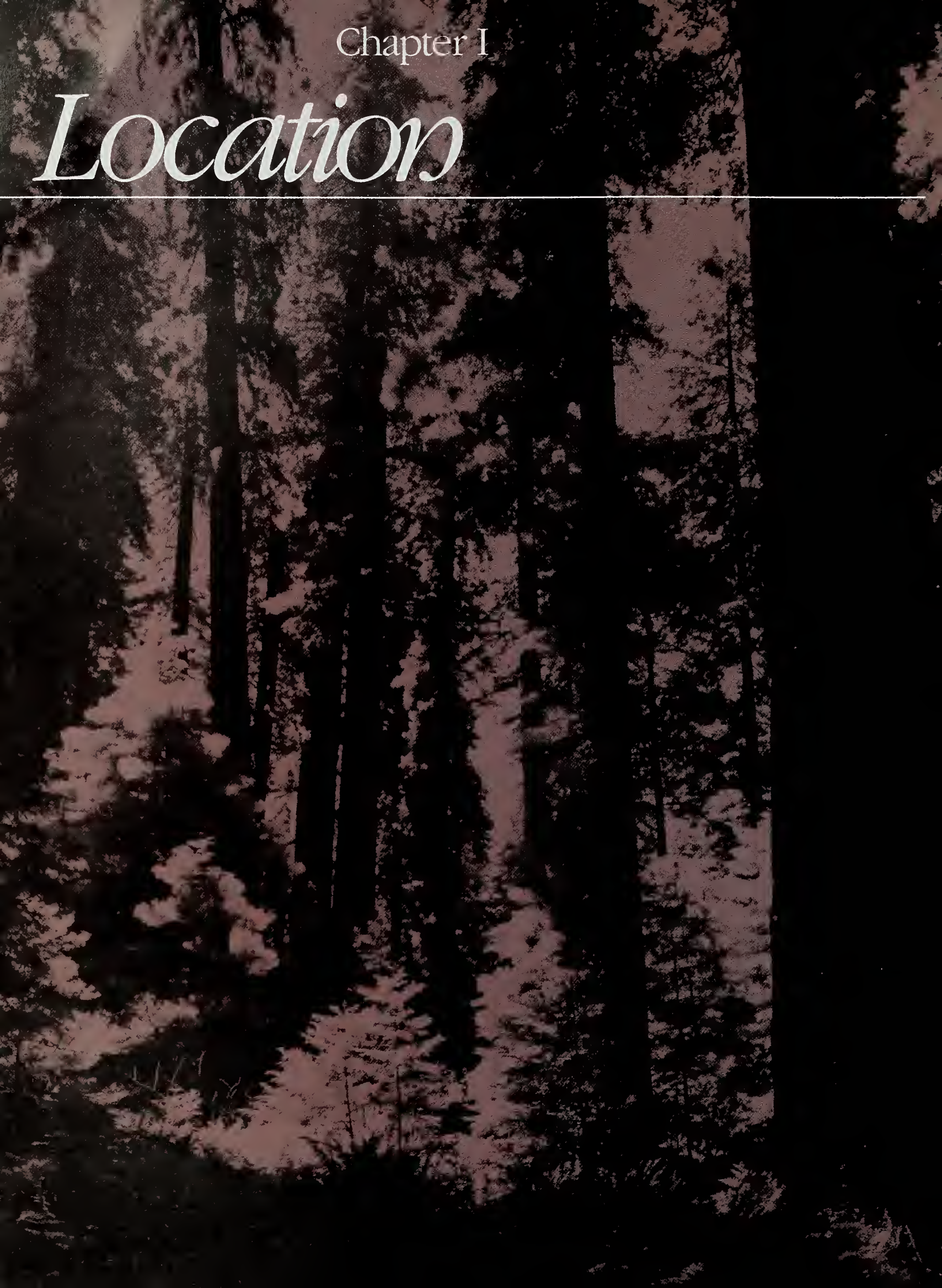
It is a privilege to be the commander of the San Francisco District during this particular time in its history. It is also a challenge to help provide a sense of continuity to the well-established tradition of excellence which has been set by all of the men and women who have served this district over the course of the past 115 years.

What follows is really their story for us to share today.

PAUL BAZILWICH, JR.
Colonel, CE
Commanding

Chapter I

Location



From just above Point St. George in the north to Cape San Martin in the south, the San Francisco District spans more than 600 miles — or about half the entire length of California's Pacific coast. And, except in its northern reaches, where it follows the Klamath River drainage system into southern Oregon, the District seldom exceeds 50 miles in width.

Of the eleven geomorphic provinces within California, three dominate the landscape: the Coast Ranges, the Central Valley and the Sierra Nevada. The Coast Ranges extend for more than 500 miles and, in the main, form the backbone of the San Francisco District. Located just inland from the ocean, their numerous, often indistinct, ridges rise from 2,000 to 7,000 feet and are separated by the valleys of several major rivers and many smaller streams.

While nature has divided the Golden State into eleven geomorphic regions, the Corps of Engineers has, in a roughly parallel fashion, arranged the region into eleven hydrographic areas. The boundaries of these coincide generally with major drainage areas that exhibit relatively homogeneous characteristics of streamflow, existing and potential water resources development and topographic and economic independence. In terms of its hydrographics, the San Francisco District is comprised of the Northern Coastal Basins, the San Francisco Bay Area (except for a small area east of Benicia, including Suisun Bay and Walnut Creek) and the northern three-fourths of the Central Coastal Basins.

The North Coastal Basins extend along the Pacific Ocean from a point just north of the California-Oregon border to the mouth of the Russian River. Throughout most of this area, mountains and rolling hills extend to the ocean, creating some of the most impressive coastal scenery in the nation. The major mountain ranges are the Klamath Mountains and the Coast Ranges, which are the sources of the largest streams in the basins: the Klamath, Eel, Mad, Smith and Mattole Rivers and Redwood Creek. The Klamath is the most substantial river system of the basin, draining 15,500 square miles or about two-thirds of the entire area.

More than a quarter of a million people live within the North Coastal Basins region. The major population centers are Eureka, Crescent City, Yreka, Weaverville and Fort Bragg, but many prefer to make their homes in the modest hamlets along the rugged coast or in the villages hidden deep within the dense forests of redwood and fir.

Since nearly half of California's vast commercial forest land is located in this area, lumbering and the processing of forest products are major industries. Commercial and sport fishing, agriculture (especially dairying) and general recreation also contribute significantly to the region's economic base.

The north coast, with its precipitous cliffs and high jutting promontories, is frequently hammered by severe storms, gale-force

Opposite page:
Redwood Forest, North Coastal Basins

winds and squalls. Tremendous waves, spawned by storms in the north Pacific, buffet the coast both summer and winter. Crescent City, particularly, has suffered damage from great sea waves (tsunamis), where seven have been recorded since 1964.

The San Francisco Bay Area hydrographically includes the Russian River Basin and all other stream basins draining directly into the Pacific Ocean between the Russian River in Sonoma County and the San Lorenzo River in Santa Cruz County. Also included are all of the stream basins draining into San Francisco Bay west of the junction of the Sacramento and San Joaquin Rivers.

San Francisco Bay actually consists of four separate bays: Suisun, San Pablo, Lower San Francisco and San Francisco Bay proper. The Bay Area encompasses about 6,100 square miles, 280 miles of bayshore and 150 miles of scenic coastline. The area's outstanding physiographic feature is, of course, the great bay itself, a vast landlocked estuarine complex through which the runoff from the entire Great Central Valley of California finds its way to the Pacific Ocean.

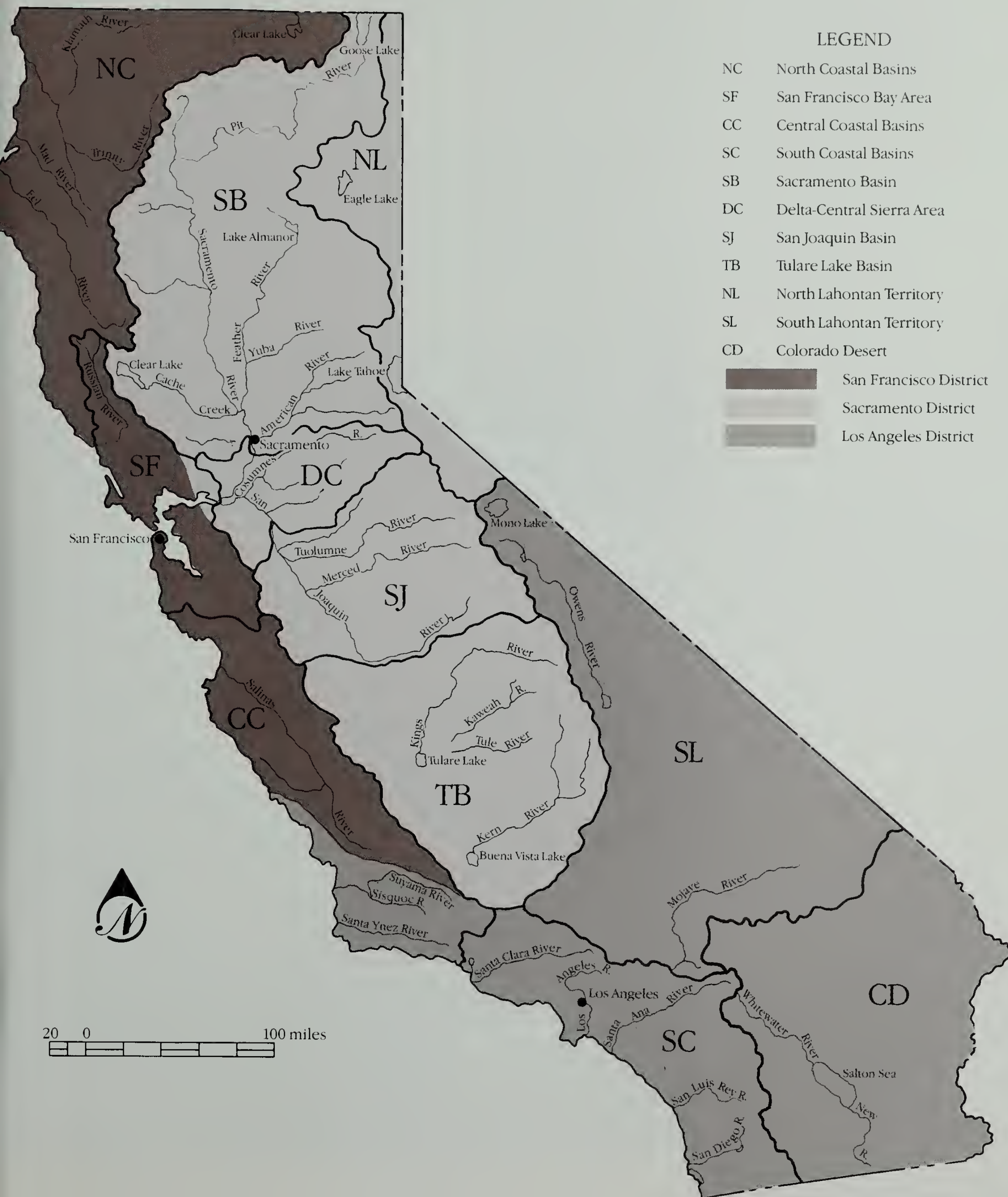
The region is characterized by varied topography that includes rugged mountains, rolling hills, numerous small stream valleys, large fertile valleys, extensive tidelands, marshlands and, like the area to its north, a truly spectacular coastline. Summers are warm and dry, winters mild, yet quite wet. Streams in the area are subject to large variations in flow, with many of them becoming dry in the summer. Major streams are the Russian, Napa and Guadalupe Rivers and Alameda and Coyote Creeks. Even though the annual precipitation for the area as a whole averages about 32 inches, the San Francisco Bay Area is water deficient and must depend upon importation of municipal and industrial supplies from the Sierra Nevada.

Coastal streams serve as critical spawning and nursery grounds for numerous anadromous fish. Approximately half a million of these fish annually pass through the bay on their way to the spawning areas within the Sacramento and San Joaquin River Basins. The bay is also highly important to the life cycles of shrimp, clams, oysters, and to many lesser-known yet vital links in the food chain that ends with man himself.

San Francisco Bay, one of the major natural bays of the North American Continent and one of the most important port complexes on the Pacific Coast, has long been considered the "Gateway to the Orient." The bay, some 42 miles long and from 5 to 13 miles wide, is connected to the Pacific Ocean by a narrow water passage known as the "Golden Gate."

Approximately five million people reside within the San Francisco Bay Area. By the turn of the century, it's expected that the population will increase to about 6.4 million. The economy of the area is dominated by highly diversified industrial, manufacturing and commercial activities. The key to the Bay Area's industrial development and high level of economic activity has been, and remains, its geographical setting coupled with excellent air, and surface and water transportation facilities.

Waterborne commerce of the Bay Area accounts for almost half of the waterborne commerce of the entire state. The major commercial ports are San Francisco Harbor, Oakland Harbor, Richmond Harbor, Redwood City Harbor, and terminal and harbor facilities in San Pablo Bay, Mare Island Strait, Carquinez Strait and Suisun Bay.



The southernmost reaches of the San Francisco District consist of the northern three-fourths of the hydrographic area labeled as the Central Coastal Basins. The entire area extends from the San Lorenzo Drainage Basin north of Santa Cruz to just south of the city of Santa Barbara and comprises a land and water area of about 11,450 square miles. At Cape San Martin, north of San Luis Obispo, the District's boundary line leaves the coast and follows a southeastern arc so as to take in the headwaters of the Salinas River. Except for river valleys, there is little or no coastal plain. Throughout most of this part of the District, mountainous terrain and rolling hills march right up to the ocean, thus producing a rugged coastal environment that is widely acclaimed and as inspiring as any on earth.

Important streams in the basins include the San Lorenzo, Pajaro, Salinas and Carmel Rivers. The Salinas River is by far the predominant stream draining over half of the total area. Its major tributaries are the Nacimiento, San Antonio and Arroyo Seco Rivers, which originate west of the main stream in the Santa Lucia Mountains. East of the Salinas, the tributary streams of Estrella and San Lorenzo Creeks pour forth from the Diablo Range. The Salinas River flows through the largest of the intermountain valleys of the Coast Ranges.

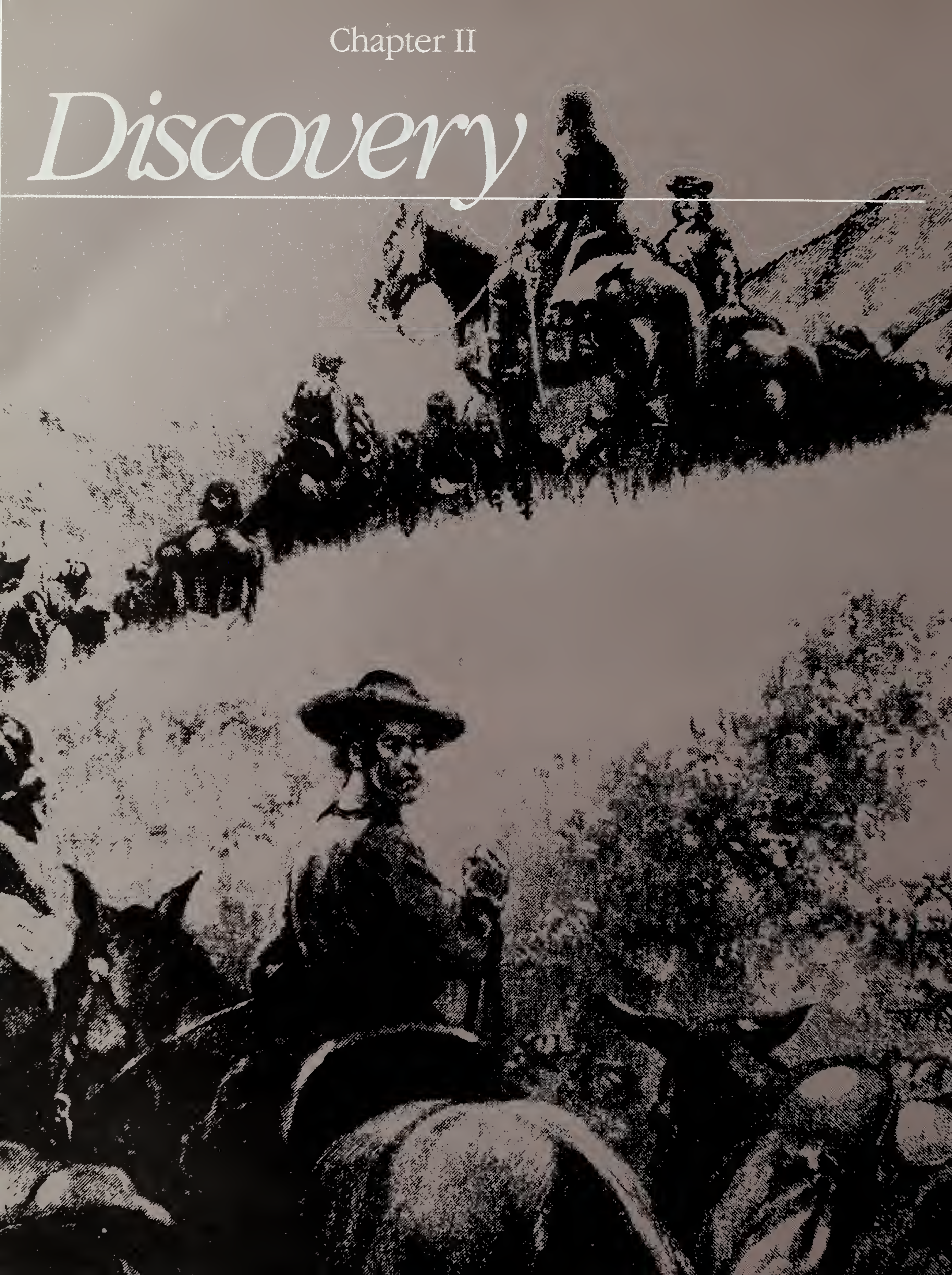
The major urban centers of this portion of the San Francisco District are Salinas, Monterey, Carmel, Santa Cruz, Watsonville, King City and Paso Robles. The economy of the region is sustained primarily by agriculture and related industries. Manufacturing, petroleum, mineral production, recreation and tourism also make significant contributions to the overall economic health of the area.

The famous Golden Gate – Entrance to San Francisco Bay

The California Coast near Monterey – Central Coastal Basins.

Chapter II

Discovery



During the reign of the Holy Roman Emperor Charles V, Spain enjoyed a period of ascendancy and splendor. No nation in Europe held so dominant a position. In the New World, the amazing energy and rashness of Spanish adventurers were carrying forward the conquest of a continent and the development of one of the richest empires the world has ever known.

As an incident in the dramatic era of exploration and conquest, the Portuguese adventurer, Juan Rodriguez Cabrillo, sailing under Spanish colors, set out from the tiny port of Navidad on the west coast of Mexico on June 27, 1542. His goal — explore the unknown sea which stretched into the dim mists of the northwest in hopes of finding the fabled Strait of Anian. Popular belief at the time held that this legendary waterway cut through the North American continent. Although disappointed of Anian, Cabrillo's party sailed and charted the entire coast of California.

Cabrillo reached San Diego Bay on September 28, 1542, remained a few days, then proceeded north, charting and giving names to salient points as he coasted the heretofore unknown shore of California. He thus was the first person of record, other than the native population, to see the area that was eventually to become the responsibility of the San Francisco District. Fog, inclement weather, or perhaps the configuration of the landscape caused Cabrillo to sail past, without seeing, the entrance to San Francisco Bay.

Cabrillo's commission was cut short by an infection attributed to a broken arm. When the brave seaman died on January 3, 1543, the pilot of the expedition, Bartolome Ferrelo, assumed command and continued probing northward. Again San Francisco Bay was unknowingly passed by, but the Farallon Islands (Spanish for sharply pointed rock in the sea) lying but a few miles off the Golden Gate, were probably spied by Ferrelo's lookouts. The expedition's final reports brought back to Mexico described an inhospitable land; one lacking convenient harbors on the coast of California.

The next visitor, and the first European to set foot on land that is presently within the San Francisco District, sailed under the flag of England and spoke the language of Shakespeare, who was then a fifteen-year-old lad at Stratford. Francis Drake, disciple of the freebooter, John Hawkins, favorite of Queen Elizabeth and scourge of Spain's Pacific treasure fleet, visited the San Francisco area early in the summer of 1579. After having pillaged the Spanish settlements and ships, Drake pressed on to the North Pacific.

Like Cabrillo, Drake also missed sighting San Francisco Bay (and Humboldt Bay, as well). At a point somewhere off Del Norte County, near the California-Oregon border, he turned south again, cruising along the coast in search of a suitable beach on which the *Golden Hind* could be put into condition for the voyage home. On June 17, 1579, he found a safe harbor. Most historians agree that he and

Opposite page:
Gaspar de Portola leads his expedition north in 1769 in search of Monterey Bay. By accident the party discovered San Francisco Bay.

Sir Francis Drake – Freebooter and the scourge of Spain's treasure fleet, he was the first European to set foot upon the land that would eventnally become part of the San Francisco District.

his crew spend some five weeks on the shore of the bay in Marin County that bears Drake's name. Located about two dozen miles north of the Golden Gate, it's an open bay with very little shelter and with but one good anchorage lying behind the hook on the end of the rugged granite headland of Point Reyes.

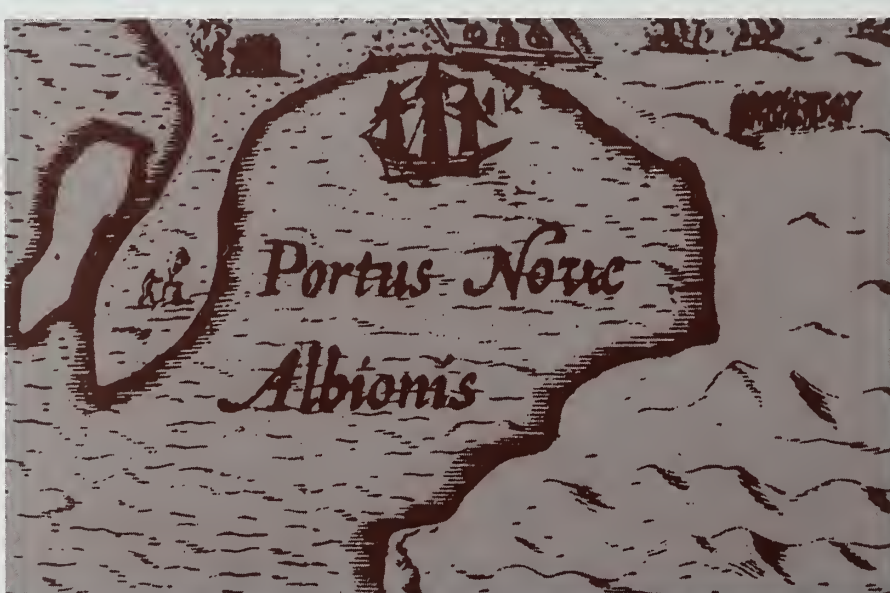
The Indian inhabitants of the region met the Englishmen with surprising friendliness, even regarding them as superior beings, and voluntarily offered their lands to the strangers. Upon Drake, they conferred the title "Hioh," the same borne by their own chief.

Drake sailed away in his little ship on July 23, 1579. Landing briefly on the Farallons (called by Drake "Islands of Saint James") to supply the *Golden Hind* with seal meat and fresh eggs, he and his party were the first white men to have set foot in San Francisco County.

History might have taken a different course if Drake had camped along what is now the Marin County coast in fair weather instead of in the fog and dismal conditions as recorded in the journal of Francis Fletcher, chaplain of the expedition. If the sun had shone and the mariners had climbed Mt. Tamalpais, looked down on the magnificent landlocked harbor below and the limitless vistas of the hills and valleys to the north, east and south, they might have decided that the more valuable treasure lay at their feet, and not in the hold of their ship. Drake might have even persuaded Elizabeth to take physical possession of the empire he had found.

Sixteen years after Drake's visit, Sebastian Rodrigues Cermeno, yet another Portuguese navigator in the service of Spain, while searching the coast for safe ports where the famed Manila galleons might find refreshment on their scurvy-ridden homeward treks, entered the same bay which had sheltered Drake. He took possession of the land for Spain, and called the bay "La Bahia de San Francisco," a name it bore for many years to the confusion of historians.

On May 6, 1602, Sebastian Viscaino embarked from Navidad to retrace Cabrillo's route in order to discover the safe harbors that



Port of New Albion – This map was published as part of a world map drawn by the Flemish cartographer Jodocus Hondius in 1589. Hondius was a friend of Thomas Talbot, Clerk of Records in the Tower of London, an official who had access to the records of Drake's voyage. In reality, the map bears a closer resemblance to the interior of San Francisco Bay – the area near Tiburon Peninsula – than it does to Drake's Bay.

Cermeno had sought. He visited most of the possible ports of California, but the entrance to San Francisco Bay eluded him on both the journey north and the return. He did, however, map and name most of the prominent features along the coast, often setting aside with fine disregard the nomenclature preferred by Cabrillo. On December 15, 1602, he entered and took possession of Monterey Bay, the first white man of record to do so.

Viscaino was so impressed with the beauty and promise of the area that his report depicted an earthly paradise around Monterey Bay and peninsula, a romantic description that persisted for a hundred and fifty years. It is little wonder that later explorers did not recognize the place when they came upon it.

The report submitted by Viscaino was so positive and the need for northern harbors so real that it is difficult to understand why more than a century and a half elapsed before it was thought worthwhile to explore the region further. Not until 1769 would a serious attempt be made to penetrate and hold the province.

With the English in an expansive mood after Captain Cook's voyages and the Russians well established in Alaska, Spain perceived that unless she took definitive action it might lose California to more aggressive colonists.

The first expedition sent to settle California consisted of coordinated sea and land groups. The overall purpose was to establish a presidio (fort) at Viscaino's Monterey Bay. Don Gaspar de Portola was in charge of the entire effort and personally led the group charged with finding the Bay. Except when mountain barriers forced them inland, Portola's men followed the coast. The huge mass of the Santa Lucia Mountains, located at the southern end of the San Francisco District, diverted their course into the Salinas Valley. And when they did finally reach Monterey Bay, it was not at the distinctive and beautiful southern end, Monterey peninsula, but farther north near where the Salinas River flows into the sea. They remained in the vicinity for quite some time, but saw nothing, in their opinions, to suggest the bay described so glowingly by Viscaino. Even though their charts indicated they were in the correct latitude, they concluded that the maps must be in error. So, disappointed, they pushed on north to search further for the perfect harbor.

On October 30, 1769, Portola and his men camped north of Half Moon Bay, probably on Martini's Creek, with the great bulk of Montara Mountain staring them in the face. From that point, it is likely that they climbed to the top of a westward flank of Montara Mountain. Forty miles to the north, they could discern Point Reyes, recognizable like the Farallons, from the maps of Viscaino and from the clear descriptions of Cabrero Bueno, pilot of one of the Manila galleons. Later, from their camp on San Pedro Creek, Sergeant Jose Ortega set out with a few men to blaze a trail to Point Reyes. On November first, they climbed to the top of Point Lobos from which they saw their way cut off by a great arm of the sea. Plodding to the east, they climbed another height, probably Telegraph Hill, and were rewarded by the view of a great body of quiet water, impassable, and thus hostile in

their eyes. They were the first Europeans to look upon the waters of San Francisco Bay.

Disappointed because they believed they had somehow missed Monterey Bay, the group determined to reach Drake's Bay, if possible, and establish a mission and presidio there. They rounded the southern end of San Francisco Bay and proceeded north through Alameda County, probably reaching Alameda Creek in the neighborhood of Niles, and going on north until, from some height, they found that their way was blocked again by a water barrier, probably San Pablo Bay. When they had carried this discouraging report back to Portola, the party retraced its path to San Pedro Creek and from there began their return journey down the coast. They stopped to erect a cross on the beach near Monterey as a token of having been there, and continued their long march, reaching San Diego on January 10, 1770.

The supply ship San Carlos was two months at sea, on her way up the coast to bring fresh supplies to the Anza colonists. The ship was the first ship of record to enter San Francisco Bay.

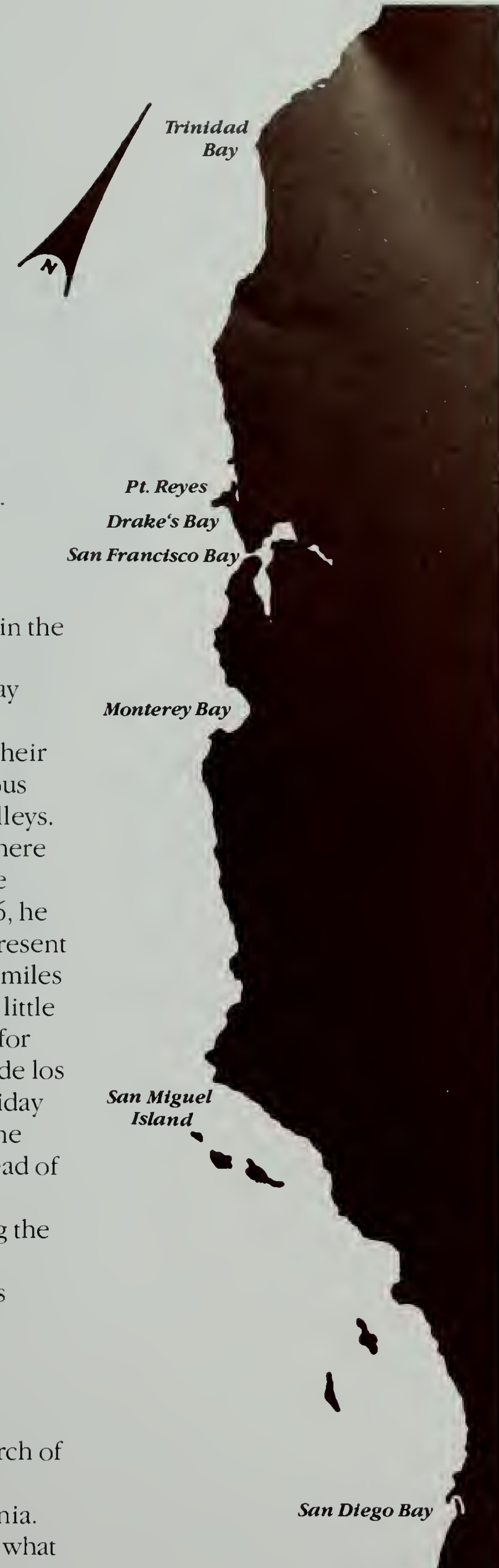
The foothold was established. It remained only for the region that was to become the San Francisco District to be colonized according to the threefold plan Spain had effectively utilized in subduing and settling the lands she conquered. Three coordinated forces, military, religious, and civil, were required by the sovereign plan. Hence, three types of institutions were set up: the presidio or military stronghold; the mission, in which was centered the spiritual life for Spaniard and Indian alike; and the pueblo or town where non-military settlers and indoctrinated natives were to live.

On the third of June, 1770, the Mission San Carlos Borromeo was established, as well as the Presidio of Monterey. Five years later the Spanish government sent a modest squadron to the San Francisco Bay area. One of these ships, the San Carlos, commanded by Juan Manuel de Ayala, reached the Boca del Puerto de San Francisco on August 4, 1775. Jose Canizares, in a small launch, undertook to enter the narrows. When his subordinate failed to return at the appointed time, the commander piloted the San Carlos through the channel and into the bay. These two were the first recorded European navigators of the Golden Gate. Ayala's party spent several weeks in the bay, exploring the entire shoreline, making maps, recording depths and, finally, confirming the beliefs of those who held that this area was indeed a favorable place to colonize. The names of Angel Island and of Alcatraz, the "Isla de los Alcatraces," or island of the pelicans, date from the Ayala expedition, although the name of Alcatraz was then applied to the island now called Yerba Buena.

Juan Bautista de Anza sits proudly astride his horse and looks over San Francisco Bay. For three months he and a band of settlers struggled through the wild regions of northern Mexico to finally reach Monterey. Anza and a small group continued north to find sites for a mission and presidio.

In another expedition by sea in 1775, the Spanish mariners Bodega and Hezeta entered Trinidad Bay, 20 miles north of Eureka, on June 9, 1775 (Trinity Sunday). A few months later, Bodega found, rather by accident, Bodega Bay, which he named for himself, and Tomales Bay, named for the Coast Miwok Indian word meaning "bay."

On the morning of October 4 a severe storm forced the expedition to raise anchor from the mouth of Tomales Bay and set sail for Monterey. The following day the explorers passed only two miles from the Golden Gate, unaware that only a month earlier the San Carlos had departed for Monterey. Bodega was afraid to enter San



Francisco Bay because of the earlier loss of his discovery launch in the storm off Tomales.

The first large-scale effort to colonize the San Francisco Bay area was undertaken by Juan Bautista de Anza. Some thirty soldier-colonists and their families and four civilian settlers and their families set out from Tubac, in Arizona. For eight hundred tortuous miles they followed Anza's lead across deserts, mountains and valleys. The colonists reached Monterey in March, 1776. Anza left them there to rest while he went on to the San Francisco peninsula to choose definite sites for the presidio and the mission. On March 28, 1776, he erected a cross near the northernmost tip of the peninsula, the present site of Fort Point, to mark the place for the presidio. About three miles to the southeast of where the presidio would stand, Anza found a little oasis on a creek and here, on March 29, 1776, he marked the site for the mission. He christened the place, Laguna de Nuestra Senora de los Dolores, because March 29, in the religious calendar, was the "Friday of Sorrows" referring to Our Lady of Sorrows, the Virgin Mary. The mission eventually built there is still called Mission Dolores instead of its proper name, the Mission of San Francisco de Asis.

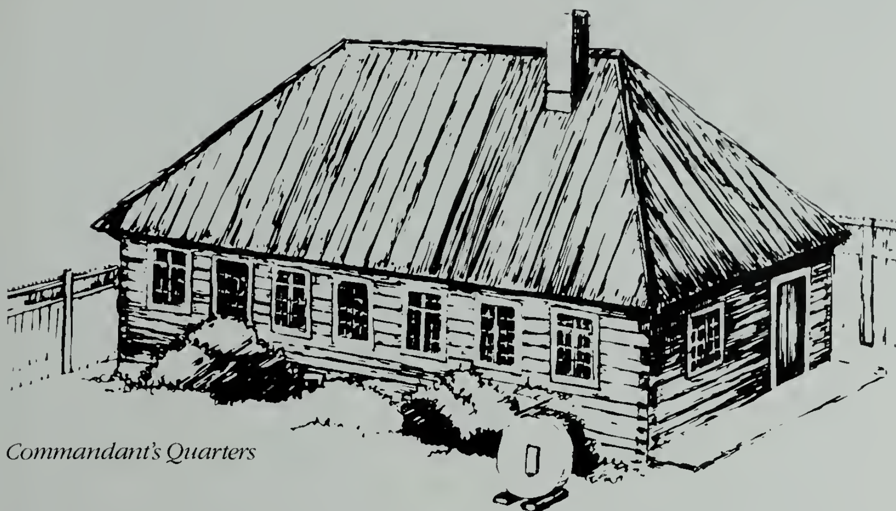
Anza returned to Monterey, turned over the task of settling the pioneers in their new home to Lieutenant Jose de Moraga and departed for Mexico. Under Moraga's able command, 193 settlers completed the last phase of their historic journey, arriving at the mission site on June 28. On the seventeenth of September, the presidio was finally occupied, becoming the first permanent settlement in the San Francisco Bay region.

Three weeks later, on October 9, 1776, the temporary church of the mission was dedicated by Padre Palou, sixth in the chain of twenty-one Franciscan missions eventually established in California. Ten of these missions were constructed within the boundaries of what now comprises the San Francisco District.

Spain sent soldiers, settlers and priests to California to settle and colonize.

It was at about this time that the entire group of Spanish frontier provinces was detached from the control of the viceroy in Mexico City and placed under the commandant-general of the "Interior Provinces," with headquarters in Sonora. From this point on, decreasing interest was demonstrated in the California area. Then, in July 1781, the Yuma Indians revolted, destroyed missions and killed many of the settlers. The Yuma massacre was one of the worst disasters in the whole history of the Spanish frontier. As a result, the Anza Trail from Mexico to the Bay Area was cut until the 1820's and, in the meantime, there was virtually no land communication between Mexico and California.

From the time of the Yuma uprising in 1781 to the final collapse of Spanish rule in Mexico in 1821, little effort was sustained to strengthen the outposts of Spain in California. The colonial empire



Commandant's Quarters

The Russian-American Fur Company arrived in 1812 and established Fort Ross on the Sonoma Coast as a base for fur hunters and as an agricultural station to supply food for their other stations in Alaska. The chapel of the fort was restored in 1917 and again in 1957. In 1970 the chapel burned to the ground. Reconstruction was completed in 1974.

was crumbling and increasingly on the defensive. While the mission system continued to expand, especially in the area that was to become the San Francisco District, it never succeeded in molding the Indians into genuine colonists. Other than the natives, there were only about 600 persons in California in 1781 and about 3,000 by 1821. The increase was due primarily to the birth of descendants of earlier settlers, however, and not to the arrival of new ones.

The last attempt, under Spanish rule, to found any new civil or military establishment was made on lands adjoining Mission Santa Cruz. Funding was inadequate and the colonists for the most part petty criminals, so it is not surprising that Villa de Branciforte did not flourish.

Chapel

Just after the turn of the 19th century, the Spanish were joined on the coast by the Russians. In early September of 1812, an agent of the Russian-American Fur Company, Kuskoff, paid local Indians for a broad stretch of the Sonoma coast on which a fortified village was built about 18 miles north of Bodega Bay. Named Fort Ross, it had a threefold purpose: produce food for itself and the company's operations in Alaska; serve as headquarters for sea otter hunting in northern California; and serve as a station for the trade the Russians hoped to establish with the Spanish California settlements.

It should be noted that Fort Ross was not the only Russian settlement on the coast. Earlier Kuskoff had planted a temporary station at Bodega Bay and another a few miles inland in the Salmon Creek Valley.

In 1841, having cleaned out most of the fur-bearing seals and sea otters in the region, they sold what was left of their holdings to John Sutter, recently established in the Sacramento Valley. During their thirty years on the coast, the Russians maintained an orderly and effective domain. Fort Roscia, the third settlement established, became headquarters for Governor Kuskoff and his three successors. It was built on a bluff above a little cove some twelve miles north of the Russian River, which they called Slavianki. The name Fort Ross grew out of the word Roscia, but no trace seems to be left of the name Roumiantzof, which was applied to the whole Russian realm.

Chapter III

Acquisition

Spanish California became Mexican California in 1822, following a dozen years of revolution, begun in 1810 by the Creole priest, Miguel de Hidalgo. But no sooner had Mexico won her independence than she entered upon a prolonged period of political instability, dissension and civil war that frequently threatened her very existence as a nation.

Even so, the dissension and revolution that kept the California provincial government in constant turmoil prior to acquisition by the United States apparently had little effect upon the routine lives of the people themselves. On the contrary, the stormy years of domestic politics closely coincided with what many are accustomed to call the Golden Age of California history.

However, by the 1840 s the long reign of anarchy and confusion in California politics had reached its climax.

Before the next round could get underway, the Anglo-American conquest abruptly brought down the curtain on the Mexican way of operating and ushered in a new wave of development.

American interest in the region began in the late 18th century when New England merchants discovered the lucrative market in China for sea otter pelts. Although the Spaniards forbade foreigners from taking furs in California waters, they couldn't prevent them from doing so. Even though there was stiff competition from the English and Russians, Americans gained the greatest share of the trade.

As early as 1808, William Shaler, who as captain of the *Lelia Byrd* had visited the California coast a few years earlier, noted that it would be as easy to keep California, regardless of the Spanish, as it would be to take from them in the first place.

By the end of the Spanish period, the fur seals and the sea otters had been just about exterminated along the coast of California. By then, New England whalers began visiting San Francisco Bay with increasing frequency, but the main American trading interst in the area now centered on cowhides and tallow. The hide and tallow trade was important not only in the economic development and history of the area, but more significantly because it increased the interest of Americans in the region. Richard Henry Dana, in his book *Two Years Before the Mast* suggested that, in the hands of a really enterprising people, the possibilities for coastal California were practically limitless.

Just as American waterborne commerce in the Bay Area had begun with the quest for furs, so the history of overland contact with the region had its beginnings in the search for beaver pelts. The first American trapper, Jedediah "Mountain Man" Smith, arrived in 1826. Contemporaries of Smith were James Ohio Pattie, Ewing Young, William Wolfskill and Joseph Walker. Each in his own way, by sharing his adventures and impressions of the Far West, encouraged other Americans to come and thus helped pave the way for eventual American acquisition.

Official American efforts to acquire California began in 1835 simply as an extension of President Andrew Jackson's plans for the purchase of Texas. Jackson mainly wanted San Francisco Bay, but all of his plans came to nought. President John Tyler, a proponent of Manifest Destiny, also wanted to make a deal with the Mexicans for the peaceful acquisition of California. His Secretary of State, Daniel Webster, working with Addy Thompson, our minister to Mexico, advocated a scheme to secure California in exchange for cancellation of American claims against the Mexican government. But, as had happened earlier, political blundering botched the plan, making peaceful cession practically beyond reach.

Acting upon inaccurate information, Commodore Thomas Jones entered Monterey Bay on October 18, 1842, and on the following day demanded the surrender of the port and surrounding district. On the 21st, however, when the Commodore came ashore in person and examined the latest official communications from Mexico, he was embarrassed to learn that he had erred rather badly. Official U.S. denunciation of Jones' conduct failed to allay Mexican fears of an American takeover.

On coming to office in March, 1845, James Polk confided to George Bancroft, Secretary of the Navy, that the acquisition of California was a prime goal of his administration. Plan A for Polk was to buy California and New Mexico. If that failed, he was ready to go to Plan B — persuade the Californians to secede from Mexico and then to protect them when they did. The latter idea had real possibilities, in that the provincial government had reached a state of truly insufferable confusion and most influential men in the region were ready for a decisive change, preferably peaceful American acquisition.

The propitious design of Polk for winning the province by deceitful, but peaceful, conciliation of the Californians was stayed by the untimely actions of Captain John C. Fremont in March, 1846.

Fremont was, and remains, one of the most controversial figures in California and, for that matter, Corps of Engineers history. For some, he was the ever-impatient opportunist. To others, he remains "The Pathfinder" and hero of the American West. As an officer in the Corps of Topographical Engineers, he led a series of exploring and scientific expeditions into the Far West. In fact, it was Fremont who gave the name "Chrysopylae" or "Golden Gate" to the Boca del Puerto de San Francisco. It has been said that he prophesied that the wealth of the world would flow in through the narrow passage.

John C. Fremont

During the spring of 1845, while in Washington, D.C., Fremont became convinced that war with Mexico was imminent and that he should lead an expedition (his third) west to aid in bringing California into the American fold. With Kit Carson as his guide, Fremont arrived in California in December and by early in 1846 appeared in Monterey.

Mexican officials, fearing that Fremont would upset the delicate political balance, ordered him out of the territory. Fremont defied the order and moved his camp to a fortified promontory overlooking the area near Mission San Juan Bautista. Though the Americans and Californians threatened for three days to come to blows, no blood was

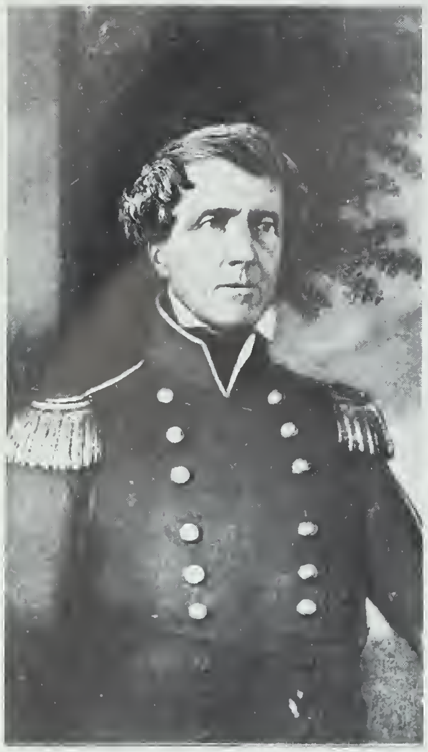
The U.S. sloop-of-war Portmouth, *center, surrounded by chartered ships carrying troops, rides at anchor in Yerba Buena Cove in this 1848 drawing.*

actually shed by either side and on March 9, under cover of darkness, Fremont and his band slipped away.

Thomas O. Larkin, U.S. Consul at Montery, tiring of Fremont's antics, sent a plea for help to Commodore John Sloat, commander of the U.S. Pacific squadron, cruising off Mazatlan, Mexico. The Consul's note stated that Captain John Fremont, a topographical engineer, was causing trouble and that shooting may start at any time. Sloat dispatched the sloop of war *Portsmouth*, under the command of Captain John Montgomery. In June 1846, when she came to anchor off Sausalito, the *Portsmouth* was visited by a messenger from Fremont requesting supplies and money. The provisions had hardly cleared the deck when word reached Captain Montgomery that a group of men from Fremont's camp had seized the town of Sonoma, clapped the Mexican General Vallejo in jail and raised the Bear Flag to declare California a free republic.

Americans in the area began to celebrate and Vice-Consul William Leidesdorff demanded action by the *Portsmouth*. But Captain Montgomery, unaware of President Polk's declaration of war the month before, disclaimed the action of the bear flaggers and refused to join the conflict. Montgomery's neutral position became more exasperating when he learned, late in the month, that Fremont was openly fighting the Mexicans and, to some degree, had assumed leadership of the Bear Flag Revolt. Remembering Commodore Jones' untimely action at Monterey in 1842, Montgomery refused to take any action likely to bring discredit upon himself or his country.

On the night of July 8, a courier galloped along the shore of the bay shouting that Sloat had taken Monterey. The United States was at war with Mexico!



Colonel Steven W. Kearny

The next morning, July 9, 1846, a party of 70 men landed from the *Portsmouth* and raised the American flag over the plaza on the beach — now Portsmouth Square. With a salute of 21 guns from the ship, San Francisco was taken from Mexico by the United States.

One can only speculate about the historic exploits of Fremont and the rough frontiersmen who rallied to the Bear Flag standard and what might have been accomplished, or what fate the California Republic might have experienced had the movement for independence been left to run its full course. The historic significance of the Bear Flag movement expired when Fremont received word on July 9 that the United States and Mexico were at war.

Even so, the passage of more than a century has done little to diminish the romantic tradition that the revolt was the means by which California won her independence, and the United States obtained possession of an incomparable empire on the Pacific coast.

Initially, the Californians offered little resistance to the Americans, but later they revolted and extensive fighting ensued before they were finally defeated. Fremont played a significant role in the military actions within California; in fact, it was he who accepted the surrender of a large Mexican force. Terms of the surrender, known as the Cahuenga Capitulations, were drawn up and signed on January 13, 1847. Nine days later, Commodore Robert F. "Fighting Bob" Stockton, sent to relieve Sloat as commander of the Pacific Fleet, appointed Fremont governor of California. Colonel Steven W. Kearny, head of the "Army of the West," peeved over Stockton's action, believed that because he was senior officer acting under official orders, he was entitled to be governor. Fremont, rather imprudently, ignored Kearny. For his part though, Kearny took a dim view of the situation and had the new governor arrested and sent to Washington during the summer of 1847.

Fremont was court-martialed for disobedience of orders and dismissed from the Army. President Polk set aside the sentence, but Fremont resigned anyway.

The cession of California to the United States was formally recorded by the Treaty of Guadalupe Hildalgo, February 2, 1848. For years thereafter, the political status of the region was rendered ambiguous and confused by the immense influx of population into California due to the discovery of gold. Civil and military governors followed one another with bewildering rapidity; the government was described as part military, part civil and part no government at all.

Famous or infamous as he was, Fremont was but one of the many Corps of Engineers officers who served within the boundaries of the present-day San Francisco District during the period of the Mexican conflict. Lieutenant William H. Emory and a 14-man topographical engineer unit served with Colonel Steven Kearny's troops during 1846. Early the next year, Emory was busy laying out plans for fortifications near the coast. After the war, Emery was elevated to the rank of Major and, serving as commission and chief astronomer, he and his engineers surveyed the boundary between Mexico and the United States. Included in the party was Lieutenant

Amiel Whipple of the Topographical Engineers and his assistant, Doctor C.C. Parry, a surgeon who also doubled as botanist and zoologist.

A contemporary of Emory was Lieutenant Henry Wagner Halleck, who prepared plans for, and constructed a fort on the present site of the Presidio at Montery. Halleck laid out the fort in the form of a bastion which overlooked the town and harbor and mounted some two dozen guns of various types. During its existence, the stronghold was known variously as Fort Halleck, Monterey Redoubt, Fort Hill, Jane's Fort, Fort Fremont and Fort Mervine.

Following the Mexican War, Halleck resigned his commission and became an influential member of the California convention of 1849. In addition, he served as an inspector of lighthouses on the Pacific coast and then went on to become president and superintendent of the New Almaden mercury mine located near San Jose. Halleck gained further fame as a partner in the San Francisco law practice of Halleck, Peachy and Billings. Over the next few years, he became a leading citizen of San Francisco and the owner of a large tract of land just north of the Golden Gate.

At the beginning of the Civil War, President Lincoln gave Halleck a direct commission as a major general and in 1862 appointed him chief-of-staff for the Union Army. As a soldier and as a civilian, then, Halleck played a significant role in the development of the area as well as helping to preserve the Union.

While Fremont, Emory and Halleck are among the more well known of the Engineer officers who were involved in the San Francisco area, they were only a few of the many Topographical and Corps of Engineers personnel who, over the years, contributed to the American acquisition of the Far West. The everyday, but important, work of the Engineers included preliminary reconnaissance of the region around the harbor of San Francisco, extensive surveys for military roads connecting strategic points along the coast, and surveys related to harbors, wagon roads and railroad routes.

Moreover, Engineers carried out reconnaissance work for fort sites, military reservations and emigrant trails. Finally, they were to do everything from exploring the rivers to observing Indian habits, mining practices and the location of mineral deposits.

William H. Emory, U.S. Military Academy Class of 1831.

Chapter IV

Foundations

During the half-century between the Mexican War and the Spanish American War, the mission of the Corps of Engineers stationed within the present-day San Francisco District was to secure the coast by constructing fortifications, protect shipping by overseeing the lighthouse program, improve communications by building roads, explore and map the area west of the Rockies and improve harbor facilities.

Fortification

Colonel Richard Barnes Mason assumed command from General Kearny for both the civil and military affairs of California in May 1847. One of his first appointments was that of Lieutenant Henry Halleck as Secretary of State. Among Mason's primary duties, however, was to make contact with the leading Californians, conduct general surveys of the region and prepare reports for Washington that summarized his findings relative to the security of the coast. In company with William Tecumseh Sherman, of Civil War fame, Mason spent much of his time traveling between San Francisco and Monterey, inspecting the ranchos and talking with the resident Mexican and Indian populations. Mason and Sherman even ventured into the mining regions of the Sierras and included information relative to gold production in the report to Washington in 1848.

While Mason was completing his inventory of conditions in the Far West, the national government was taking steps to provide stable military and civil organizations for the region. With the acquisition of Oregon in 1846 and California in 1848, the necessity for an expanded policy became obvious.

On the civilian side of things, Oregon achieved territorial status in 1848. The affairs of California remained tied up with the overriding slavery issue and the area never did get territorial status, but simply became a state in 1850. Meanwhile, the War Department's General Order No. 49 of August 31, 1848 established the Army's Western or "Pacific" Division.

This same order directed the Topographic Bureau to furnish officers for four of six Military Districts: Oregon, California, New Mexico and Texas. Given the fact that there were only some 650 enlisted men and a correspondingly small number of officers in the Engineer and Ordnance Departments in 1848, fulfilling the manpower requirements for providing security and engineering in the vast trans-Rocky Mountain frontier was quite difficult. Frequent interruptions and delays occurred.

Opposite page:
San Francisco waterfront, 1885.

Colonel Richard B. Mason

Early in 1849, Colonel Mason was relieved by Major General Persifer F. Smith as commander of the Division of the Pacific. And as he had with Mason previously, Lieutenant Sherman served as adjutant to Smith. Viewing San Francisco initially from the tossing deck of the steamer *California*, Smith was decidedly unimpressed with just about everything in the place. In one of his reports, he stated flatly that San Francisco was in no way suited for either military or commercial purposes. He pointed out that there was no developed harbor, no good docking facilities, no water of any quality, nor was there an adequate supply of provisions. Even the weather was uncooperative. And being situated on the tip of a peninsula, thus cut off from the surrounding area, even the location was considered unacceptable.

Nonetheless, the General set up his headquarters in the adobe customs house on Portsmouth Square. He didn't stay long, but soon moved Division headquarters to Sonoma. General Smith was replaced by General Washington Seawell in the spring of 1851. In October of 1853, Seawell's successor, Brigadier General E. A. Hitchcock, transferred Division headquarters to the newly completed facilities at Benicia. At about the same time, the Military Departments of the Army were reorganized. Except for Utah and New Mexico, the entire country from the Rockies to the Pacific was designated the Department of the Pacific.

During the same period, the Pacific Coast Board of Engineers, created to survey the needs of the entire coast, was directed to afford special concern for the fortification requirements of San Francisco Bay. One of these priorities was Alcatraz Island. Earlier, in November of 1850, Alcatraz had been declared a military reservation but, due to a lack of money and available manpower, little if any improvements were made. Finally, in March of 1853, Congress appropriated a half million dollars for the construction of fortifications in and around San Francisco Bay. Under the supervision of Lieutenant Zealous Bates Tower of the Corps of Engineers, the sloping sides of the island were blasted away and, utilizing hired civilian labor, improvements undertaken. Water cisterns, powder magazines and protective shelters were carved out of the island. A guardhouse was put up and a special furnace was built in which shot could be heated.* Alcatraz was garrisoned in 1859, and by the spring of 1860 boasted an armament of 84 guns and more than 19,000 shot and shell. Moreover, engineer troops would occasionally augment the artillery companies normally posted on the tiny, but powerful island fortress.

Another priority, and the most important defense project of the pre-Civil War period, Fort Point became the most substantial coastal fortification on the Pacific Coast. In 1851, when General Hitchcock directed the engineers to prepare and submit plans for the defense of the bay, they recommended forts for the bay's entrance and at Alcatraz Island, with supporting batteries at Point San Jose (Fort Mason) and on Angel Island. Fort Point was literally built on top of the old Spanish fortress El Castillo de San Joaquin. Over the years, the Spanish

William T. Sherman, U.S. Military Academy, Class of 1840 and General Sherman during the Civil War.

*See Appendix A for a description and explanation of the "Hot Shot Technique."

Fort Point, 1865 – The first floor housed storage rooms, the jail, powder magazines and privies. The second floor contained the officers' mess, officers' quarters, a hospital and privies. The third floor housed the enlisted men's quarters and mess – and more privies. The top floor was the uppermost platform for the fort's many guns.

fortress, situated at the tip of the peninsula, fell into disrepair and finally succumbed to the combined forces of apathetic troops, earthquakes, saline air and Pacific storms.

The razing of El Castillo de San Joaquin and the reduction of Cantil Blanco (white cliff) to the water's edge was begun under the supervision of Lieutenant Colonel James L. Mason, Corps of Engineers. Earlier, Mason had contracted a tropical disease at the Isthmus of Panama, and was not a well man when he arrived at the Presidio. A stubborn officer, he refused hospitalization, but devoted himself to the strenuous tasks at hand, which resulted in his premature death on September 5, 1853.

Colonel Mason was succeeded in turn by Major John G. Bernard, Lieutenant Colonel Rene E. DeRussy, Major Zealous Bates Tower, *Lieutenant G. W. C. Lee (son of Robert E. Lee) and *Captain Jeremy F. Gilmer. Under the direction of these Engineer officers, work at Fort Point continued for about eight years. Eventually the cost of construction ran to almost three million dollars.

The basic design for Fort Point closely resembled those used in the construction of eastern forts. Built on a rock ledge ten feet above the water, it was intended to provide a field of fire from the entry channel to the bay from Point Bonita to Alcatraz. Constructed almost entirely of brick, the fort is a massive, irregular quadrangle 250 feet long, 150 feet wide and 45 feet high. In places, the walls are twelve feet thick, and present an unbroken surface except for the three tiers of gun-ports on the sides facing the Golden Gate. A fourth set of guns, which covered both land and sea approaches, was placed on top of the fort, protected and concealed by a barbette. In addition, high vertical windows and rifle ports open on the land approaches.

Inside the massive structure, covered galleries open on a central court. Fluted iron columns on the south side of the court area support the gallery of the second and third tiers, where the officers, troop quarters, a small hospital and a kitchen were located. Beneath these, on the ground floor were work shops, the main powder

*Lee and Gilmer served as Major Generals in the Confederate States of America Army during the Civil War.

magazine, storage facilities and a jail. Three octagonal towers support the spiral staircases which afford access to the gun corridors on each of the levels.

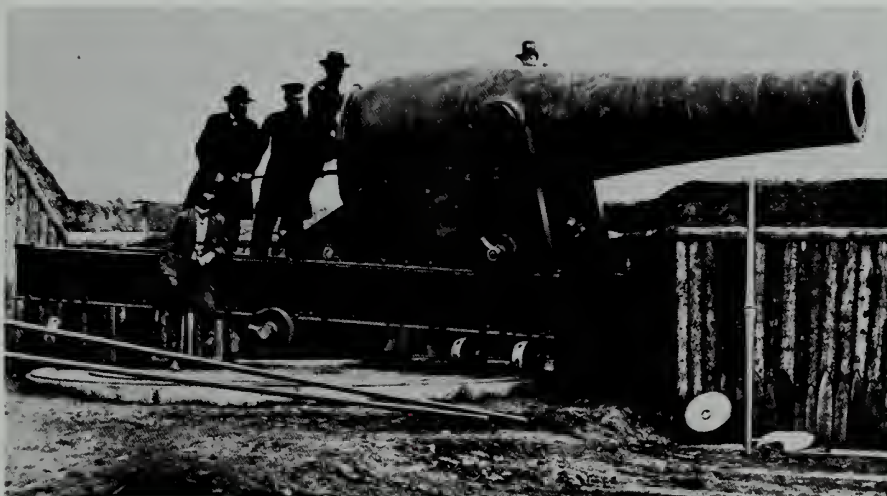
California suffered its first economic recession in 1855, making the costs of material and labor substantially less than would have been the case only a few years prior. Master stone and brick masons were paid $250 a month, while other workers were paid on a daily basis. Skilled craftsmen such as carpenters, blacksmiths and bricklayers generally earned between $4 and $6 a day, while laborers received $2 per shift. Whenever possible, the Engineers secured building supplies and materials from local firms. Bricks were by far the largest construction item. Most of those used for facing the fort were purchased from the J. Clay Brickyard located at Russian Hill for $30.50 per thousand. Common bricks were obtained from a variety of sources at prices ranging from $12 to $14 per thousand. About the only construction items not secured from local firms were some of the iron castings and all the tar and mastic for the roof, which was shipped from New York.

Once construction had been completed, the armament was installed. By 1862, a total of 137 cannons of various types were in place guarding the entrance to the harbor. The majority of the guns were located in the arched casement rooms on the north side of the fort. Thirty gun rooms were located on each of the three floors. The guns fired through open ports in the outer wall, except for those located on the top floor barbette, which they fired over the walls. Cannon balls ranging from 24 to 128 pounds could hit an enemy ship two miles distant.

During the summer of 1867, the fort was garrisoned by 343 officers and men of Companies H and K, 2nd U.S. Artillery, and Company F, 9th U.S. Infantry. When these troops were transferred to other stations, they were replaced by Company D, U.S. Engineer Battalion. The Engineers, who had been sent to the Pacific Coast from Willet's Point, New York, remained at Fort Point until March 17, 1868, when they were sent to Yerba Buena. With the departure of the Engineers, the post was merged with that of the Presidio and for the next ten years no troops were billeted in the fort.

Work on Fort Point, under the direction of the Corps of Engineers, had been excellent in quality and carried forward in good fashion. Until technical developments achieved during the Civil War made brick and mortar fortification vulnerable to improved weaponry, Fort Point was considered a strong bastion for the defense of San Francisco Bay. The fort was abandoned in 1886, and the muzzle-loading cannon removed about 1900.

While construction was being carried forward on Alcatraz Island and at Fort Point, the old Spanish/Mexican Presidio was being modernized. New facilities for regular troops and officers were rapidly replacing the adobe buildings put up years before. After 1853, rehabilitation of the Presidio progressed quickly. In 1857 Major General Newman S. Clark, commanding officer of the Department of the Pacific, moved his headquarters there.



A gun crew attends huge smooth-bore cannon at Fort Point.

After completion of Fort Point in 1861, the Presidio area was further strengthened by the construction of Battery East, which as its name implies, was located just east of Fort Point. Its field of fire was primarily limited to the narrowest portion of the Golden Gate and the inner harbor. Between 1870 and 1875, fifty 15-inch Rodman guns were placed there. Later, around 1885,a number of these 11-foot smooth-bore muzzle loaders were fitted with rifled sleeves and remained in service until after the turn of the century. The smooth-bore cannon and Civil War Rodman guns at Battery East, later known as Fort Scott, became obsolete by the late 1880s, and were replaced during the next decade.

At one time, the parapet of the Battery East was 36 feet thick and the magazines covered with at least five feet of earth. Moreover, the brickworks in this emplacement were similar to that of Fort Point.

Construction of improved fortified positions increased significantly during the mid and late 1890s and culminated in the establishment of a string of powerful batteries from Fort Point to the area south of the western end of Crissy Field on the Presidio. The westernmost of these was Battery Chamberlain, near Baker's Beach. It was officially named on December 27, 1894, and mounted four 6-inch disappearing guns. In 1904 these guns were removed and a pair of more up-to-date barbette-mounted 6-inch rifles were put into place.

A half mile north of Chamberlain and well forward towards the beach, was Battery Crosby. Its two emplacements were completed in 1900 and its 6-inch disappearing guns mounted a year later. East and north of Crosby was Battery Saffold. A pair of 12-inch guns were mounted there in 1899.

Flanking Saffold on the north, just off Lincoln Boulevard was Battery Dynamite. Next in line on the heights above the bay were Batteries Godfrey, Boulette, Miller, Cranston and Lancaster. These were armed with a variety of weapons ranging in size from three to 12 inches.

The most easterly batteries in this line of defense were Baldwin, Sherwood, Blaney and Slaughter, located on a ridge south of Crissy Field. Remnants of these old fortifications can still be found

Panoramic view of the Presidio of San Francisco.

among the trees and shrubs across Highway 101 from the San Francisco National Cemetery.

Yet another series of exterior earthen barbettes reinforced with brick walls was built above Fort Point proper. Begun in 1870, these defensive works extended for three quarters of a mile along an unbroken, irregular semicircle, facing generally west and north. Thirty large caliber guns, including at least one 20-inch rifle at the center salient, and a dozen 12-inch heavy mortars were mounted in batteries along its length. The system also included traverses, magazines and shelters. Later, in 1886 (and after), some of the smooth-bore 10-inch Rodmans were retubed with 8-inch rifle cores.

District Engineer 1866-1871
Maj. Robert S. Williamson

The Corps of Engineers also carried out fortification work on Angel Island. The first step in the actual erection of batteries was taken on August 24, 1863, when Major Robert S. Williamson, Corps of Engineers, visited the island and completed a survey of the terrain. On September 9, Battery B, 3rd Artillery, was directed to proceed to Angel Island to assist the Engineers in the construction of the new works.

Four barbette batteries were eventually constructed on the island. Two were built on the western side near Point Stuart and Point Knox, where their guns controlled Raccoon Strait. A third battery was mounted near the wharf at Camp Reynolds, named to honor Major General John F. Reynolds, killed at Gettysburg, July 1, 1863. The fourth battery was emplaced at Point Blunt, where its guns could be coordinated with those on Alcatraz.

Little was done on Angel Island after 1865 to improve its fortifications. The works constructed during the Civil War were allowed to deteriorate. In 1870, the Board of Engineers for the Pacific Coast prepared quite an elaborate project for the rehabilitation of the

island defenses, but little of the proposal was actually carried out. Batteries were maintained, however, for a number of years, particularly at Battery Knox. Finally, about 1900, the old armament on the island was removed and three new batteries were installed, all on the southwest shore: Battery Drew, Battery Wallace, and Battery Ledyard.

It was Alcatraz, however, that remained for many years the major artillery station in the Bay Area, and efforts were sustained to keep its weapons current with the latest technical advancements. In 1876 plans called for thirteen batteries mounting thirty-six 15-inch guns. But from 1872 on, the island was increasingly used as a military prison because Fort Leavenworth was unable to house the many prisoners. Indian prisoners were also held on the island.

Plans to fortify the northern shore of San Francisco's Golden Gate began shortly after California's entry into the Union in 1850. From the beginning, the idea was to build fortifications that would function as adjuncts to armament on the southern shore, at Fort Point initially, and then later at Forts Winfield Scott, Funston and Miley. In 1853, Colonel Joseph K. F. Mansfield of the Corps of Engineers advised strongly that a powerful battery be built on a site across the channel to overlap the field of fire of the guns suggested for Fort Point. It would be years, however, before any guns would be emplaced in the area.

As ships enter the Golden Gate, they pass on their north side Point Bonita, Point Diablo and Lime Point. The last is directly across from and closest to Fort Point, hence the logical place for fortification. Originally the Spanish named the promontory San Carlos, but Americans changed it to Lime Point because of its white appearance. Actually, the place got its color not from lime deposits, but from those made by countless sea birds.

The site selected for fortification by the Army Engineers was part of the Lime Point Military Reservation, the name given to a strip of land stretching from Cavallo Point to Tennessee Cove by executive order of President Millard Fillmore in 1850. Problems arose when it was discovered that the land had been part of W. A. Richardson's El Rancho Sausalito. He sold it to a San Francisco realtor named S. L. Throckmorton who claimed the land as his own. Thus, if the government wanted it, they'd have to buy it.

Subsequent investigations and negotiations involving the title, the land, and its eventual acquisition by the government constitute one of the significant chapters in the history of the San Francisco region. Not only did the question of purchase bring controversy to the halls of Congress, but it also involved the Corps of Engineers in the tangled California politics of the time.

Prior to 1852, the government laid claim to the tract on the basis that title to the land never properly passed to private individuals from the Mexican authorities in the first place. Therefore, it was federal property. Richardson, on the other hand, submitted documentation to the United States Land Commission in support of his claim. Finally, on April 2, 1857, Richardson's title was confirmed. Sam Throckmorton, learning of the government's interest in the land, bought it from

David Broderick

William M. Gwin

Richardson. On October 4, 1855, he wrote to Lieutenant Colonel R. E. DeRussy of the Corps of Engineers, who was then supervising the construction of Fort Point, and offered to sell the Lime Point property to the government for $200,000. Colonel DeRussy thought the asking price was entirely out of line and told the Chief of Engineers, Brigadier General Joseph Totten, how he felt in his letter of November 3, 1855.

When Jefferson Davis, then Secretary of War, got word of Throckmorton's offer, he directed a board to survey the land in question and to outline the exact area needed for government purposes. In addition, orders were sent to the U.S. District Attorney in San Francisco to investigate the title of the land selected by Colonel DeRussy and the Board of Engineers. The area finally chosen included Point Cavallo, Lime Point and the area in back of and above Lime Point — about 600 acres all told.

After the United States Attorney General validated the Throckmorton Title, Senator John B. Weller of California suggested to his fellow law-makers that $300,000 be appropriated for the purchase and fortification of an additional site on the Golden Gate. Weller explained that he expected two-thirds of the funds would be utilized to purchase the land.

On April 23, 1857, in a communication to Totten, DeRussy stated that, in his opinion, the 600 acres required for the new fort were worth no more than $60,000. Moreover, he recommended that Captain Henry W. Halleck, of the law firm of Halleck, Peachy and Company, be retained to negotiate with Throckmorton and prepare documents required to consummate the sale. DeRussy's idea was accepted and Halleck employed. He was to receive $1,000 for his services, plus ten percent of any reduction he could effect from the government's ceiling of $100,000. His efforts came to nothing, however, because Sam Throckmorton refused to deal.

It was at this point that the Lime Point negotiations became part of the bitter political feud between U.S. Senators William M. Gwin and David C. Broderick. Gwin, originally from Tennesse, and Broderick,

from New York, both came to California as political opportunists. Gwin arrived in the new state first, got the edge he needed, and was able to defeat Broderick's 1854 attempt to win the senatorial election in the California State Legislature. Two of Gwin's staunch backers were U.S. Senator John B. Weller, and Justice David S. Terry of the California Supreme Court.

By 1857, Gwin felt the need of Broderick's support to guarantee retention of his seat in the Senate. In what has been referred to as a corrupt bargain, the rivals agreed to assist one another for their common good. The bargain struck was simply that in return for a virtual monopoly of federal patronage in California, Broderick agreed to support Gwin in the senatorial election. In the end, both Gwin and Broderick became U.S. Senators. And, despite their bargain, their basic dislike for one another quickly resurfaced. The renewed quarrel was enjoined as a result of Gwin breaking his pledge about federal patronage and as a result of Broderick's injured pride when President James Buchanan showed sympathy for Gwin's view of slavery and snubbed Broderick.

Looking for an opportunity to discredit Gwin and his friend, Weller, Broderick brought up the Lime Point negotiations. He charged that the entire affair, including Weller's motion of March, 1857, to appropriate $300,000 for the purchase and fortification of the tract, was nothing more than an attempt to swindle the government. The partisan newspapers in California gave extensive and often sensational coverage to the affair as well as to Broderick's accusatory attack in the Senate upon the proposed Lime Point acquisition.

Sam Throckmorton, peeved about the developments, drafted a defensive letter to Secretary of War John B. Floyd in June of 1858 absolving himself—categorically stating that he was guilty of no wrongdoing. A month later he wrote the Secretary again, complaining that negotiations had already strung out for two and half years and that the government had thus been the cause of his suffering financial loss. On September 16, 1858, Secretary Floyd told Throckmorton that the proceedings in regards to the purchase of the Lime Point property would be discontinued as a consequence of Broderick's declarations on the floor of the Senate. Thus, for the time being, Broderick was able to stall the sale.

Gwin, reacting to the attack on January 31, 1859, moved that the Committee on Military Affairs conduct an investigation into the allegations of fraud relative to the Lime Point purchase. The motion passed, and the Committee made a thorough investigation, which held that the agents of the government were blameless. Despite the majority opinion, Senator Broderick a member of the Committee, submitted a scorching minority report blasting the transaction from all sides, even unsuccessfully questioning the validity of the title once again.

The questions of fraud and title had been answered but not that of price. Witnesses were called and questioned about the value of the land. In all cases, the testimony corresponded exactly to the evaluation given by Colonel DeRussy of the Corps of Engineers. As

negotiations over price dragged on, Broderick was able to get a resolution passed that suspended the purchase of Lime Point until after the Civil War. At the close of the conflict, negotiations were reopened with the result that the Lime Point property was purchased from Throckmorton for $125,000 on July 24, 1866.

The problems between Gwin and Broderick, however, continued unabated. In the California elections of 1859, the Gwin group won a sweeping victory over the Broderick men. During the campaign, Chief Justice David S. Terry, a candidate for renomination to the State Supreme Court, aligned himself with the Gwin forces. Terry, bitter over being denounced by Broderick, and because he failed to win renomination, resigned from the bench, and shortly afterward challenged Broderick to a duel. This was fought on September 13, 1859, south of the City in a ravine near the ocean. Broderick fired first and missed. Terry took careful aim and shot Broderick in the chest. Broderick died from his wound.

The early failure to procure Lime Point did not preclude continued ambitious planning for the installation of armament there. In February, 1862, Colonel DeRussy suggested a 20-gun battery for Lime Point. A few months later he recommended a battery with twice as many cannon.

A Fort Point-type fortification of brick and stone was proposed for Lime Point in 1867. It was to consist of two casemate tiers containing 86 guns and a barbette tier of 23 guns. Excavations for this masonry fort began in 1868 and constituted a "first" in the history of Corps of Engineers excavating, in that blastings of this magnitude had never before been attempted.

Lieutenant Colonel George H. Mendell — using brevet rank, Regular Army rank, Major, 1864-79 — Corps of Engineers, was placed in charge of the entire project. The first step involved the construction of a base camp known as Engineer Village in the cove between Lime Point and Point Cavallo. The second phase of the operation consisted of building a wharf, "Engineer Wharf," and a wagon road a few feet above the water to the point. Construction of these progressed slowly, and at considerable cost, but the work on excavation for the fort could not begin until the support facilities were completed. By the end of 1867, officer's quarters, barracks, and about half a dozen smaller buildings had been put up. During this same period, a modest breakwater was formed by filling an area between the shore and a large rock.

District Engineer 1871-1895
Maj. George H. Mendell

While the plan for a casemated fort at Lime Point was similar to that of Fort Point, the bluff at Lime Point was composed almost entirely of rock. In one of his reports, Mendell pointed out that the hill was almost inaccessible and no one but an expert climber could scale its slopes, even in the most favorable places. The job of cutting down a section of the steep, rocky hill to a level 20 feet above the bay was going to be difficult.

Traditional excavation for a project of this kind called for teams of three men each to drill 25-foot holes into the rock, pack them with black powder, and blast out a segment of the rock. But the magnitude

of this project, if conducted upon traditional methods, would mean that more than a hundred squads of drillers would be needed. Moreover, this method would prove inordinately slow and expensive.

Mendell decided to be innovative and use a more spectacular, quicker and, it was hoped, more economical approach. He called the plan a "system of mines." Following his directions, the engineers dug three tunnels deep into the cliff, each with a series of pockets that were packed with several thousand pounds of explosive. The idea was to blast the entire face of the cliff away with just a few massive charges.

The men began work on the first tunnel on March 7, 1868, and finished on May 11. It was 125 feet long and had a pair of powder chambers six feet high and four feet wide. Into these were placed thousands of pounds of black powder. On May 14, 1868, using a device known as a Beardslee magnetic exploder, the engineers touched off the charge. The outer portion of the main tunnel remained intact, and so on May 28, a second explosion was fired. This first set of explosions had consumed a total of 10,150 pounds of powder, and loosened more than 50,000 cubic yards of rock.

Working from the land toward the bay, two additional tunnels were drilled into the bluff. One, blasted in October, had five branch tunnels with chambers at ends of each. Into these were packed almost twelve tons of powder. The third tunnel utilized more than eight tons of explosives stuffed into three powder chambers, and was exploded in April 1869. Brigadier General Barton S. Alexander, Corps of Engineers, invited to witness the operation, was singularly impressed. He noted that there was no explosion in the popular sense of the term, but simply that a little smoke and flame were observed through the moving mass of rock, as the entire face of the hill in front of the charges moved outward and fell into the sea. He was especially awed by the fact that no sound could be heard from the exploding powder, and that not a stone was thrown 50 feet by the force of the explosion.

Despite the success enjoyed by Lieutenant Colonel Mendell at Lime Point relative to his new system of excavation, the work upon the site was halted in 1869, and the plan to construct a Fort Point type fortification abandoned. The Army Board of Engineers had finally absorbed the lessons learned during the Civil War concerning the vulnerability of masonry forts.

Three basic possibilities were next considered for future harbor defense fortifications that would stand up to rifled cannon and high explosive projectiles. One plan utilized armor plate, another explored the development of a radically different type of gun carriage that would reduce exposure of personnel and equipment, and the third employed earthworks. The last was finally seen as the most feasible, at least in the short view.

Earthwork emplacements were not only economical to construct, but also had the advantage of committing the least amount of building material. These were changing times, and if a better solution could be found, or some new problem arose due to further studies in ordnance development, corrective measures could be adopted quickly and without having to tear down expensive emplacements.

Six fortifications of the earthworks type were proposed by the Board of Engineers for the Lime Point area. Other batteries in the 1870 project were Battery Cavallo, south of Yellow Bluff; Point Cavallo Battery; Ridge Battery, on the summit above Lime Point; and emplacements at Points Diablo and Bonita. All were designed primarily around the 15-inch Rodman smooth-bore cannon, the epitome of unrifled ordnance.

Mendell was in charge of construction for the 1870 project and, as before, was faced with significant problems. The immediate task was to level off the peak above Lime Point to accommodate Ridge Battery. It was to be the highest artillery emplacement for coastal defense in the United States — 475 feet above the water. The general work of developing Lime Point reservation continued rather extensively from 1869 to 1875 in spite of budgetary cutbacks and included the construction of batteries, powder magazines, roads, buildings and other facilities. By 1872, batteries mounting 50 guns were completed and by the turn of the century the northern shore of the Golden Gate was a rather heavily fortified area.

In 1885, the Endicott Board, a presidentially appointed body, conducted a study of the defenses of seaports and harbors of the United States. Deriving its title from the then Secretary of War, William E. Endicott, the board drew up a list of 27 harbors and suggested the kind of armament it felt would best defend them. It should be noted that San Francisco was rated second only to New York in order of importance. The board's recommendations for the defense of San Francisco Bay called for 110 8-inch to 12-inch guns, three floating batteries mounting 10-inch guns, 18 torpedo (mine) boats and 1,050 underwater mines.

Five years later, planning was begun for what later became known as the 1890 Project. As a result of the Endicott Board proposals, and the 1890 Project, the following batteries were constructed on the Marin County headlands between 1893 and 1905:

A. Spencer, Fort Baker, three 12-inch guns on barbette carriages

B. Duncan, Fort Baker, two 8-inch guns on barbette carriages

C. Kirley, Fort Baker, two 12-inch guns on disappearing carriages

D. Wagner, Fort Baker, two 5-inch guns on balanced pillar mounts

E. Mendell, Fort Barry, two 12-inch guns on disappearing carriages

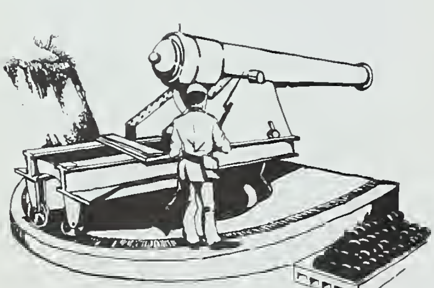
F. Alexander, Fort Barry, eight 12-inch mortars

G. O'Rorke, Fort Barry, four 3-inch guns on pedestal mounts

H. Guthrie, Fort Barry, four 6-inch guns on pedestal mounts

I. Rathbone, Fort Barry, four 6-inch guns on pedestal mounts

J. Yates, Fort Baker, six 3-inch guns on pedestal mounts.



This new generation of fortifications differed significantly from those of the early period. Changes included the use of reinforced concrete in lieu of brick and earth and the reduction of armament to a single gun for each parapet, except in the case of mortars. Unlike the earlier emplacements, where each battery's configuration depended for the most part upon the nature of the site, the latter batteries tended to be more standardized and were usually built in two stories. Earthen batteries of the 1860s and 1870s were built upwards from a pre-selected level. The newer batteries, on the other hand, began with an even parapet close to ground level and were constructed downward, resulting in two-storied structures with the guns actually resting on the top floor with the magazines beneath them.

On May 4, 1897, the name of Lime Point Military Reservation was changed to Fort Baker in honor of Colonel Edward Dickenson Baker, who was killed by Confederate troops at Balls Bluff, Virginia, on October 21, 1861 (Adjutant General's Office General Orders No. 25). Then, on December 27, 1904, the western half of the fort, known as Point Bonita, was established as a separate post and named Fort Barry to honor Brevet Major General William F. Barry, who fought in both the Mexican and Civil Wars and later commanded the California Military District.

One of the last fortified areas on the bay to receive improvements was Fort Mason. Alternately referred to as Black Point and Point San Jose, the post lies deep within the bay and was thought of as a second line of defense. President Millard Fillmore set aside the reservation on November 6, 1850, as a regular military installation. Lack of funds, however, delayed plans for installation of guns and by 1853 squatters had settled on the land. The War Department, fearing Confederate privateers, ousted the squatters in 1863 and took action to fortify the area. Supposedly, the land belonged to John C. Fremont, but according to newspaper accounts of the time, the government confiscated it in the national interest.

In 1865, the fort became the headquarters for the Commanding General of the Department of the West. Behind its earthen barbettes, in 1876, rested a half dozen 10-inch Columbiads, the same number of old 42-pounders, and three 15-inch smoothbore cannon. The post was renamed to honor Colonel Richard B. Mason on November 25, 1882. It will be remembered that Colonel Mason was an early military/civil governor of California. Fort Mason remained for many years the place of residence of the division or departmental commander since it possessed the only really suitable house in the immediate area. Later, in 1887, a new residence was built on the post.

During the 1890s, much of the old armament was replaced by newer, more effective rifled guns, and once again Fort Mason assumed the role of an active coast artillery post. The last of the big guns were removed in 1917.

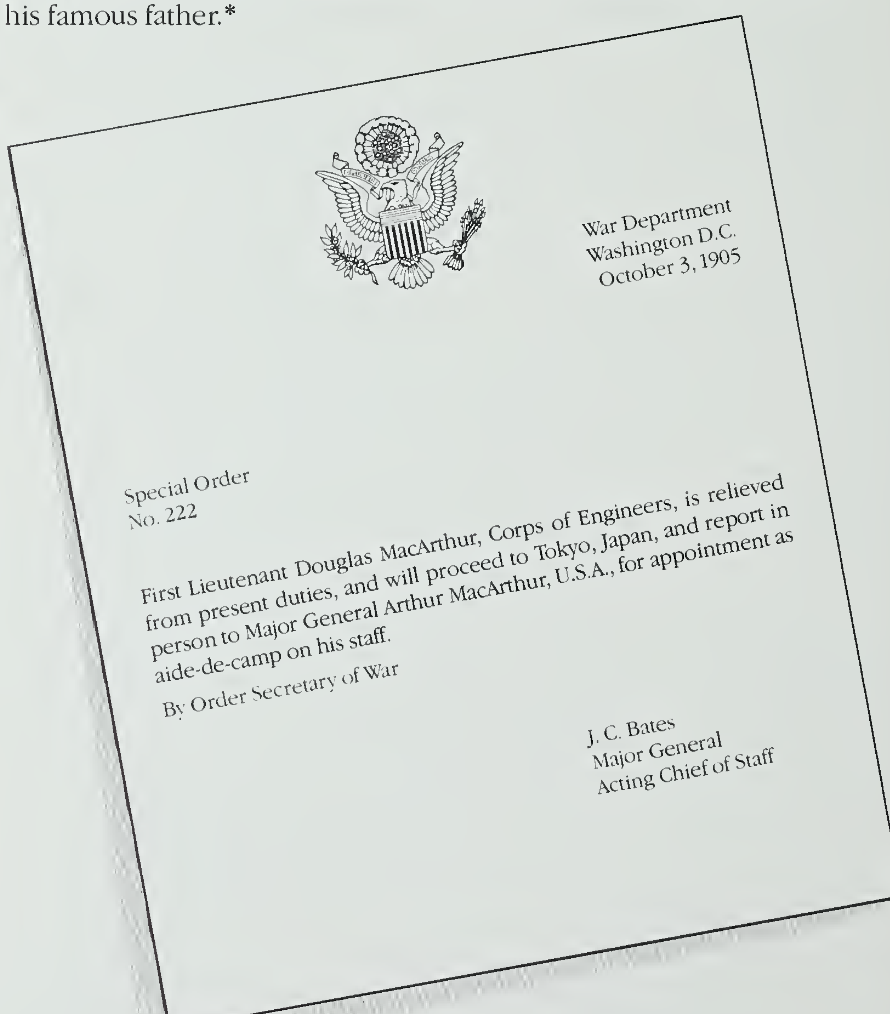
By the end of the 19th century, San Francisco Bay was probably the most completely fortified harbor within the United States. In designing and building the defensive works, the Corps of Engineers followed the basic theme of constructing a gauntlet of cross fire

"Headquarters" Fort Baker, California.

capable of pouring a continuous and lethal stream of shot and shell from Point Lobos to Telegraph Hill, a distance of some six miles. It was believed that no vessel or even fleet of the time could penetrate the bay and survive.

Of all the Corps of Engineers officers who served in the Bay Area during this period, the one who would eventually gain the greatest notoriety was Douglas MacArthur. MacArthur graduated from West Point in 1903 and was assigned to the Philippines. In 1904 he was promoted to First Lieutenant and ordered to San Francisco. During October of that year he sailed for the Golden Gate aboard the transport *Thomas*. Upon his arrival MacArthur, serving under Major William W. Harts, was directed to work on the harbor fortifications being built to protect the Bay. According to MacArthur's own recollection, he enjoyed his duties at San Francisco. Just a year later, in October 1905, he was transferred to the Far East to serve as an aide to his famous father.*

General Douglas MacArthur



War Department
Washington D.C.
October 3, 1905

Special Order
No. 222

First Lieutenant Douglas MacArthur, Corps of Engineers, is relieved from present duties, and will proceed to Tokyo, Japan, and report in person to Major General Arthur MacArthur, U.S.A., for appointment as aide-de-camp on his staff.

By Order Secretary of War

J. C. Bates
Major General
Acting Chief of Staff

*Major General Arthur MacArthur was commanding general of the Pacific Department in 1901-05. He requested special assignment to Japan as an observer in January 1905 and it was approved by Secretary of War Taft. Douglas wanted to go with him then, but his father said no — he had to learn to obey orders, to fulfill his assignment to the District.

Lighthouses

The Army Corps of Engineers began supervising lighthouse construction in 1831 when the Treasury Department placed funds appropriated for these improvements under the authority of the Chief of Engineers for disbursement.

With the creation of the National Lighthouse Board in 1852, Corps of Engineers officers continued to play a key role in supervising the construction, maintenance, and inspection of these important safety beacons. Three engineer officers were members of the original Lighthouse Board and one was assigned as Inspector of the lighthouse districts.

The initial appropriation for lighthouse construction on the Pacific Coast was made by Congress in September 1850. Originally $90,000 was earmarked for lighthouses to be erected on Alcatraz, at the entrance to San Francisco Bay, on the Farallones, at Monterey, Point Conception and San Diego. Then, during March of the next year, an additional $15,000 was appropriated for the construction of a tower at Humboldt Bay.

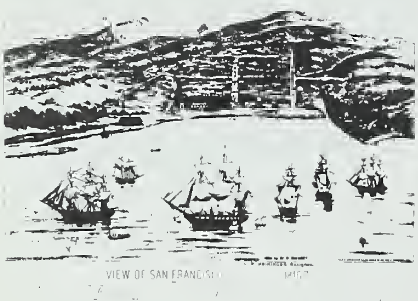
The rugged coast, the famous and potentially lethal fog banks, severe Pacific storms, the strong ocean currents, and the presence of underwater hazards and reefs all pointed toward the need to improve navigation along the San Francisco District's shoreline. Beginning with Spanish explorers, and later the seal hunters and the argonauts of '49, dozens of sea captains lost their ships, passengers and cargos on the rocks that stud the coast. Passage of the Golden Gate has always been dangerous for vessels, made doubly so by prevalent fogs. Often, early day skippers would have to spend days fogbound off the coast waiting for the impenetrable blanket to lift. Thus, an unpleasant part of this waterway's history has been the tragic end of many ships entering San Francisco Bay.

Several place-names within the San Francisco District owe their origins to shipwrecks. Duxbury Reef and Point, west of Bolinas, are so-called because the *Duxbury* grounded on the reef on August 21, 1849. Just south of it, the wreck of the steamer *Tennessee* in March, 1853, gave the names to the point, cove and valley. The *Tennessee* ran aground just outside the Golden Gate on the north shore. It was trying to enter the harbor with six hundred passengers after a run from Panama and had struck the beach two and a half miles beyond Point Bonita. Fortunately, because of quick action and calm weather, everybody was rescued.

Just weeks later, on the foggy night of Monday, June 6, 1853, the clipper ship *Carrier Pigeon*, 130 days out of Boston and laden with supplies for the goldfields, ran aground south of the Golden Gate on a headland then known as Whale Point. Although the ship itself was a total loss, Captain Doane and his crew labored to save as much of the cargo as possible and there ensued a drama typical of the pioneering days of coastwise shipping in the San Francisco District.

When news of the accident reached San Francisco, the *Sea Bird*, a sailing vessel with auxiliary steam engines, headed for the disabled *Carrier Pigeon* to attempt salvage operations. Later the same day, the *U.S.S. Active*, enroute to the Farallon Islands with materials for the lighthouse then being constructed there, changed course and put in near Whale Point. It was learned that the *Carrier Pigeon's* crew was safe and housed at the whaling colony that gave the place its name.

The *Sea Bird* arrived on the ninth of June and began salvage of the stranded ship's cargo, but soon succumbed itself to the raging seas. Damaged badly and leaking heavily, the *Sea Bird* was intentionally grounded at nearby Point Ano Nuevo to prevent its sinking. During the two weeks that followed, ships from all over the central coast converged upon the two helpless vessels, scavenging everything possible before heavy seas, for which that area is noted, finally smashed the *Carrier Pigeon* to splinters. So notorious did the incident become that Whale Point was re-christened Pigeon Point.



San Francisco Bay from an original sketch – 1848.

Even with the demonstrated need for lighthouses, construction was delayed for a year and a half after the appropriations of 1850 and 1851 had been made. Part of the reason at least stems from the fact that men and materials were hard to come by in California at the time. The historian, Hubert Howe Bancroft, reported that the lighthouses to be established were constructed under a contract awarded to the Baltimore, Maryland firm of Gibbons and Kelly. It's interesting to note that the bark, *Oriole*, which carried the company's men and equipment to San Francisco, was finally wrecked near the mouth of the Columbia River.

In 1854 the legendary Lieutenant George Horatio Derby was appointed Superintendent of Lighthouses for California and Oregon. Under his supervision, five lighthouses were completed within the San Francisco District by 1855. These consisted of installations at Alcatraz, Fort Point, Point Bonita, Point Pinos at Monterey and on the Farallons.

The first to be completed was on Alcatraz Island in 1854 and the second at Point Bonita. The latter was built on the highest part of the promontory and, because of the altitude, it was frequently obscured by fog. In heavy fogs only a sound device would be effective. To warn sailors during these times, a cannon was obtained from Benicia Arsenal and mounted on Point Bonita in 1855. Sergeant Maloney, ordered to fire the gun every half hour during fogs, all but died of exhaustion there at one time because there was almost continuous fog for two months and he had scarcely time to sleep. After two years of rather ineffective service, the cannon was replaced by a more effective type of a signal. But despite its dubious value, the cannon was the first fog signal on the Pacific Coast. In 1877, a new lighthouse was built on the very tip of Point Bonita, some 200 feet lower in elevation than the original beacon.

Probably the most original concept for a fog signal was devised by Major Hartman Bache and placed on South Farallon Island to supplement the lighthouse there. In 1858, Major Bache mounted a locomotive whistle over the upper end of one of the island's covered surge channels. The high trumpet-like device was blown by the rush

of air generated by wave action as it surged through the passage (sea cove) connecting with the ocean. The ingenious device performed well in good weather but reportedly remained inconveniently silent when the ocean calmed during a fog. This unique fog signal was eventually destroyed by a storm, but as late as the early 1950s the bricked-up aperture remained.

The next lighthouse to be constructed was built at Humboldt Bay. The first recorded discovery of the bay was made in 1806 by Captain Jonathan Winship, while he was hunting for sea otters. Winship named the harbor the Bay of the Indians because of the numerous Indian villages found along its shore. The next person of record to "discover" the bay was Dr. Josiah Gregg. Employed by the government to trace the Trinity River from its source to its mouth, he and his companions left the vicinity of Weaverville on November 5, 1849, and reached the bay on December 20. He gave it the name Trinity Bay. In April of 1850, Lieutenant Douglass Ottinger, in command of the *Laura Virginia,* anchored in the bay and named it Humboldt Bay to honor the great German scientist Baron Alexander von Humboldt.

Word spread quickly about the rich timber and farming lands that bordered the bay, and soon miners, lumbermen, ranchers and their families moved into the area. The tremendous quantities of redwood at its doorstep, together with the ever-increasing demand for lumber, skyrocketed Humboldt Bay to a place of prominence on the Pacific Coast. It was not long before redwood lumber was being shipped out in quantity, especially to fill the needs of the building boom going on in San Francisco. In 1854, two brothers, George and John Cooper, founded a combination flour and sawmill south of Eureka. The plant operated with some success until 1861, when raiding Indians killed George and set fire to the mill.

To assist the captains of the increased numbers of sailing vessels using the harbor, an appropriation was granted in 1851 for the

Fort Humboldt –1853

James Ryan – founder of Eureka.

G-Street, Eureka – 1864.

construction of a tower. A year later, an additional $5,000 was allotted for the placing of a beacon in the harbor and the following year another supplemental funding measure provided buoys for the bay. The tower for the lighthouse was erected on the north side of the entrance near the channel. When the light finally arrived in 1856, Humboldt Bay could claim a lighthouse.

Like the area around Humboldt Bay, Crescent City came into its own during the 1850s. Settlers flocked to the area in 1850 as a result of the discovery of gold on the Trinity River. Although a number of vessels — the *Paragon*, the *Cameo*, and the *Laura Virginia* — had anchored in the crescent-shaped bay as early as 1850, no settlement was made north of the Klamath until after 1852. Shortly thereafter, miners eager to locate a short communication line via the coast to San Francisco laid out the town of Crescent City in February 1853. At approximately the same time, the R.W. Knox Company of San Francisco shipped a complete sawmill to the area. By the summer of 1854, 300 buildings had been erected and the town was the center of an ever-growing trade with the interior settlements.

With the feverish business activity and expanding social life of the community came the need for a safer harbor. The first light for the harbor was a lantern fixed on top of a pole in 1855. This was replaced by a lighthouse erected by the Corps of Engineers in 1856, under the direction of Major Hartman Bache, from his office in San Francisco. The lighthouse was located on Battery Point, so named because of three brass cannons placed there in 1855. They had been salvaged from the steamer, *America*, which was wrecked and burned near there on June 24, 1855.

Contrary to what its name may imply, the Pacific Ocean is not, at least in the area of the San Francisco District, peaceful. During the summer, fog frequently visits the area. In fact, Cape Mendocino, the most western point in the United States south of Alaska, is almost

always shrouded in fog during the summer. And even during the relatively calm months the wind reaches considerable velocities. With winter come the storms that have blown for hundreds of miles from the Gulf of Alaska to slam into the Pacific Coast. These conditions, coupled with increased waterborne traffic along the California coast following the Civil War, heightened the need for improved and expanded navigation aids.

During the late 1860s, Major R. S. Williamson, and other Corps of Engineers officers in San Francisco, as engineers for the 12th and 13th Lighthouse Districts, worked to determine the siting for additional lighthouses and to provide their needed supplies. Mounting numbers of lives and ships were being lost and action had to be taken to make coastal shipping safer.

A case in point was the tragedy that struck the *Brother Jonathan* on July 30, 1865. Owned and operated by the California Steam Navigation Company, the vessel was plying the waters west of Point Saint George under the command of Captain Samuel J. DeWolfe when she was suddenly overtaken by a severe storm. The immediate thought was to seek a port of safety, so the captain made for Crescent City Harbor. But hidden just below the surface of the water lay Saint George's Reef, directly in the path of the vessel. Suddenly she struck the concealed barrier with such force that her foremast went through the hull, with her foreyards resting across the rails. The ship sank so quickly that only a boatload of some 19 people were saved while more than 100 passengers and crew went down with the ship.

Plans for lighting the site were studied by the Lighthouse Board, but its inaccessiblity generated tremendous cost estimates and presented unprecedented construction problems. In the meantime, Congressional funding did permit the construction of lighthouses at Point Mendocino in 1868 and at Santa Cruz in 1869. The following year, lighthouses at Point Reyes and Point Arena were completed, followed by a light at Trinidad Head, north of Humboldt Bay, in 1871.

Battery Point Lighthouse – built in 1855-1856 – is one of the oldest in the West. Today it is a museum visited by thousands each year.

Crescent City – 1850s.

Point Arena Lighthouse – Its classic candlestick design was copied in many other places. The Point Arena light was destroyed by the 1906 earthquake, but rebuilt soon thereafter.

During that last year, the Corps of Engineers established the Portland District, under the direction of Major Henry M. Robert. Major Williamson turned over those duties associated with the 13th Lighthouse District to Major Robert. In 1872, Williamson was promoted to Lieutenant Colonel and continued his work along California's Pacific Coast. That same year, the Pigeon Point lighthouse was completed.

For twenty years after the breaking up of the *Carrier Pigeon* at Whale Point, there was a growing agitation to build a warning device on the point to reduce its toll of unwary ships. And even as the small whaling industry declined, the cove to the south of Pigeon Point became the shipping point for products, primarily lumber and produce, from the region around Pescadero. The often heavy and hazardous surf made the use of standard docks and wharfs unsuitable for cargo handling. Ships loaded and unloaded their materials by way of aerial cableways, much in the same manner that lumber was being loaded in the "dogholes" off the Mendocino Coast.

Following a rash of shipwrecks in the late 1860s, Congress in 1869, finally appropriated money to construct a lighthouse at Pigeon Point. By September, 1871, a steam-operated fog signal with a 12-inch whistle was installed. The next year the lighthouse was completed. It had not been a simple task, for the bricks used to put up the tower had been manufactured in Norfolk, Virginia, shipped around Cape Horn and then laboriously unloaded on the swinging cableway in the rocky cove near the point.

The nine-foot diameter fresnel lens for the light has an interesting history of its own. Built in Paris by Henri Le Paute in the 1850s, it was probably installed at Cape Hatteras on the North Carolina coast. During the Civil War it was removed to prevent its destruction by Confederate forces and buried in the sand for protection. Then, in 1868, it was dug up and eventually sent to Pigeon Point. There are more than a thousand pieces of glass in this durable fresnel lens, which has served the region well for over a century.

Originally, illumination for the light was achieved by burning lard. Later kerosene was used, and now electricity provides the light which the fresnel lens magnifies to 800,000 candle-power, a beam that can be seen 18 miles at sea. When first installed, rotation was by means of a clockwork mechanism, but it now rotates electrically. Because of the natural setting and its classic New England design, Pigeon Point lighthouse has long been one of the most photographed landmarks associated with the Corps of Engineers within the confines of the San Francisco District. Since the light was put into service, only a single ship has wrecked on the point. In 1897, the *Columbia* went aground while carrying a load of white lead. According to one source, most of the houses in the area have been painted white ever since.

As was often the case, lack of funds slowed additional lighthouse construction within the San Francisco District. Nonetheless, by 1880, lighthouses had been constructed on Yerba Buena Island within San Francisco Bay and at Point Montara, located just a few miles north of Half Moon Bay. Meanwhile, on the North

Coast, the disaster of the *Brother Jonathan* was still on peoples' minds. The victims of the wreck were taken ashore and placed in the *Brother Jonathan* Cemetery. The inaccessibility of the reef area and the high waves continued to stymie engineers when it came to erecting a beacon. In 1882, however, a contractor accepted the challenge the sea offered and began unloading his foundation materials via a high line cable strung to the reef. The cost of construction ran higher than expected and funds were exhausted before the job was completed. A few years later, additional funds were appropriated and the construction project begun anew. It was completed in 1891.

Ill-fated Brother Jonathan.

The Saint George Reef Lighthouse (Northwest Seal Rock Light) is one of the greatest structures of its kind ever erected by the United States government. More than four years and three-quarters of a million dollars were required to complete the project. The lighthouse is on a small, lonely isle seven miles off the coast and thirteen miles northwest of Crescent City. For many years it was manned by Captain John Olsen and four assistants. Virtual prisoners of the tower the year round, they could barely step out of doors in good weather and during storms even this was denied them. For almost a century now the powerful beacon has guided scores of vessels away from the treacherous reefs hidden near its base.

Even though funding for lighthouses remained modest as the 19th century drew to a close, the Corps of Engineers, working from their headquarters in San Francisco, continued to serve as lighthouse engineers and also provided an engineer secretary to the Lighthouse Board of the Treasury Department. In this capacity, they completed surveys and plans while providing required services and supplies to the stations. By the end of the century, new lighthouses had been built at Point Sur and Point Ano Nuevo. Soon thereafter, because of another *Brother Jonathan*-type disaster, Congress appropriated funds for a light to be placed on Mile Rock, just outside the Golden Gate. The *Rio de Janiero* had gone down there with a loss of 110 lives. And like the

The Northwest Seal Rock Light built at Saint George Reef proved to be one of the costliest structures of its kind ever built. This dramatic photo shows the facility being resupplied during a storm.

situation at Saint George Reef, offshore construction was extremely difficult but not impossible. The light was placed in service in 1906. Lighthouse engineers in San Francisco also supervised the completion of a lighthouse at Point Cabrillo, south of Fort Bragg.

In 1910 Congress created the Bureau of Lighthouses. Pursuant to the new law, the Corps of Engineers was relieved of lighthouse work, other than occasional consultation sessions.

Maps and Roads

During the 1840s, a primary goal of the national administrations was the acquisition of the Pacific Coast. A major objective of this goal was the gathering of accurate geographical information about the region. With this in mind, several scientific/ military expeditions were sent west to explore and map the trans-Rocky Mountain area. John Charles Fremont made a total of five excursions into the far West. It was during his second trip west, on February 14, 1844, that he, in company with Charles Preuss, discovered Lake Tahoe.

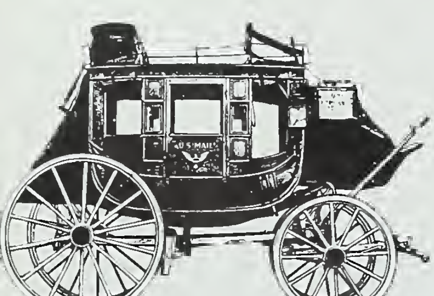
In 1846 Fremont traversed the entire coast from San Francisco to Los Angeles, while taking part in the fighting against the Mexicans.

Lieutenant William H. Emory, both during the Mexican War and after, conducted extensive surveys throughout the Pacific Coast region. In fact, the information he set down in his reports influenced topographical activities in the area for many years. In 1849-50 Captain Howard Stansbury and Lieutenant John Gunnison conducted extensive mapping expeditions throughout the inter-mountains west.

Routes mapped by the Stansbury expedition were routes that later were used by the pony express, overland stage, and the Union Pacific Railroad. Meanwhile, Captain William Warner and Lieutenants George H. Derby and R. S. Williamson left San Francisco and were busy exploring the coast, the Central Valley and the Sierra Nevada. Captain Warner, in fact, was killed by Indians soon after he had discovered a new pass through the mountains. Later, Lieutenant Derby mapped much of the California area.

One of the largest single mapping operations of the Topographical Corps associated with the San Francisco District was in connection with the Pacific Railroad surveys of the early 1850s. On March 13, 1853, Congress passed an act authorizing the Secretary of War, Jefferson Davis, to carry out explorations, as he deemed advisable, so as to find the most practical and economic route for a railroad from the Mississippi River to the Pacific Ocean. Gaining an appropriation of $150,000 to complete the task, Davis ordered officers of the Army's Engineer Departments, and others, to take the field.

Initially, four major parties began the survey work almost simultaneously. In the north, Major Isaac Stevens, then governor of Washington Territory, assisted by Captain George B. McClellan, surveyed the route between the 47th and 49th parallels from St. Paul to



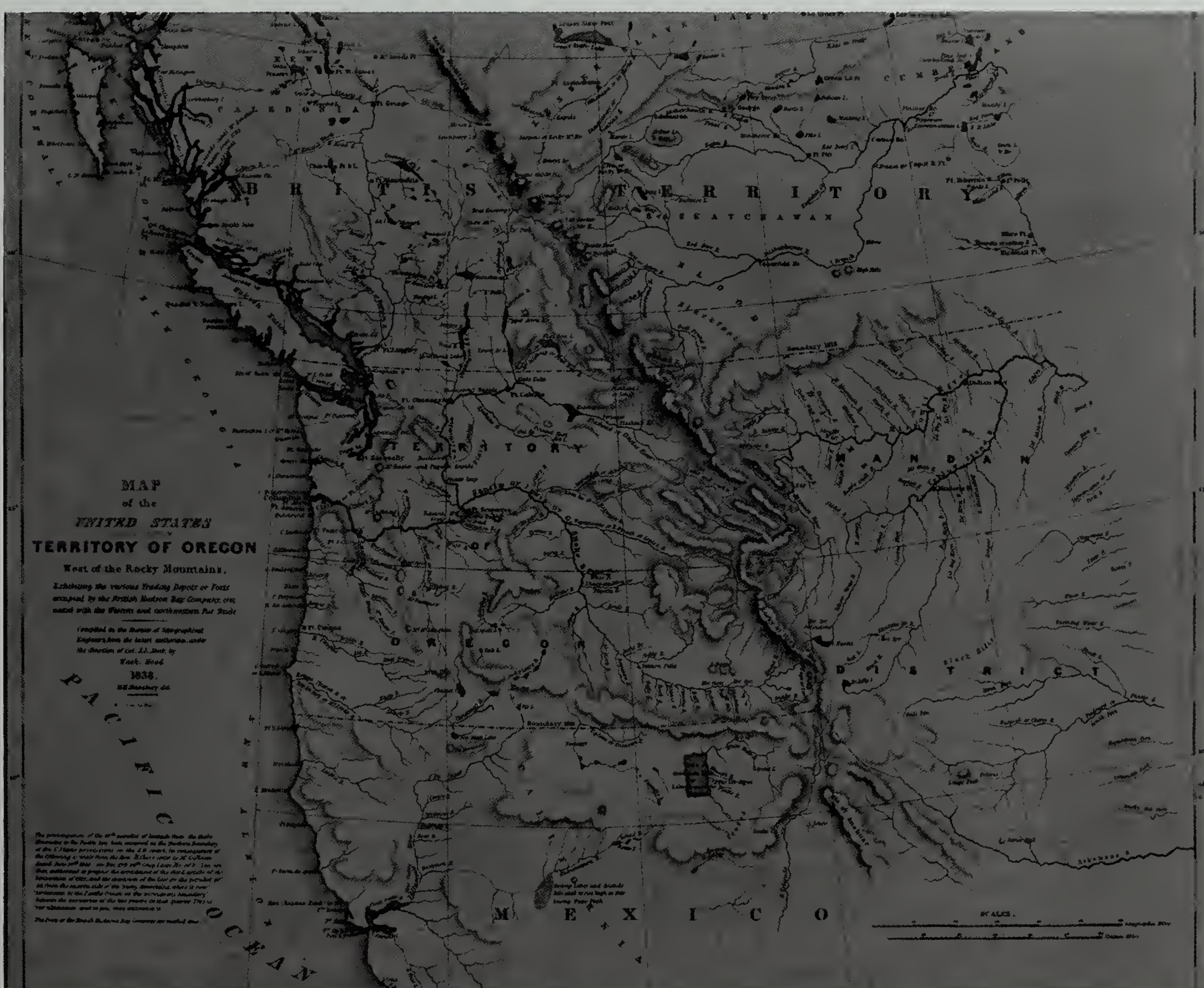
Puget Sound.

Lieutenants John Gunnison and E. C. Beckwith, an Artillery officer, set out from Fort Leavenworth early in the summer of 1853 to explore the central route. Gunnison met his death at the hands of Indians only four months after leaving the post. Beckwith pressed on, finally reporting favorably on a route along the 41st parallel.

A third group led by Lieutenant Amiel W. Whipple, the able assistant on the Mexican Boundary Survey, was ordered to explore the 35th parallel route via Albuquerque and Zuni to the Pacific. At the same time, a new 32nd parallel route was being mapped by Major William H. Emory, Captain John Pope and Lieutenant John G. Parke. The examination of an extension to this last route was carried out by Lieutenant R. S. Williamson and covered the area from the mouth of the Gila River to San Francisco.

The fourth major survey was accomplished within California. Led by Lieutenants Williamson and Henry L. Abbot, the expedition focused on two objectives: the location of suitable passes through the

U.S. Territorial Map. Compiled by topographical engineers, 1838.



Coast Ranges and the Sierra Nevada and the mapping of routes to be used to connect California with settlements in the Northwest.

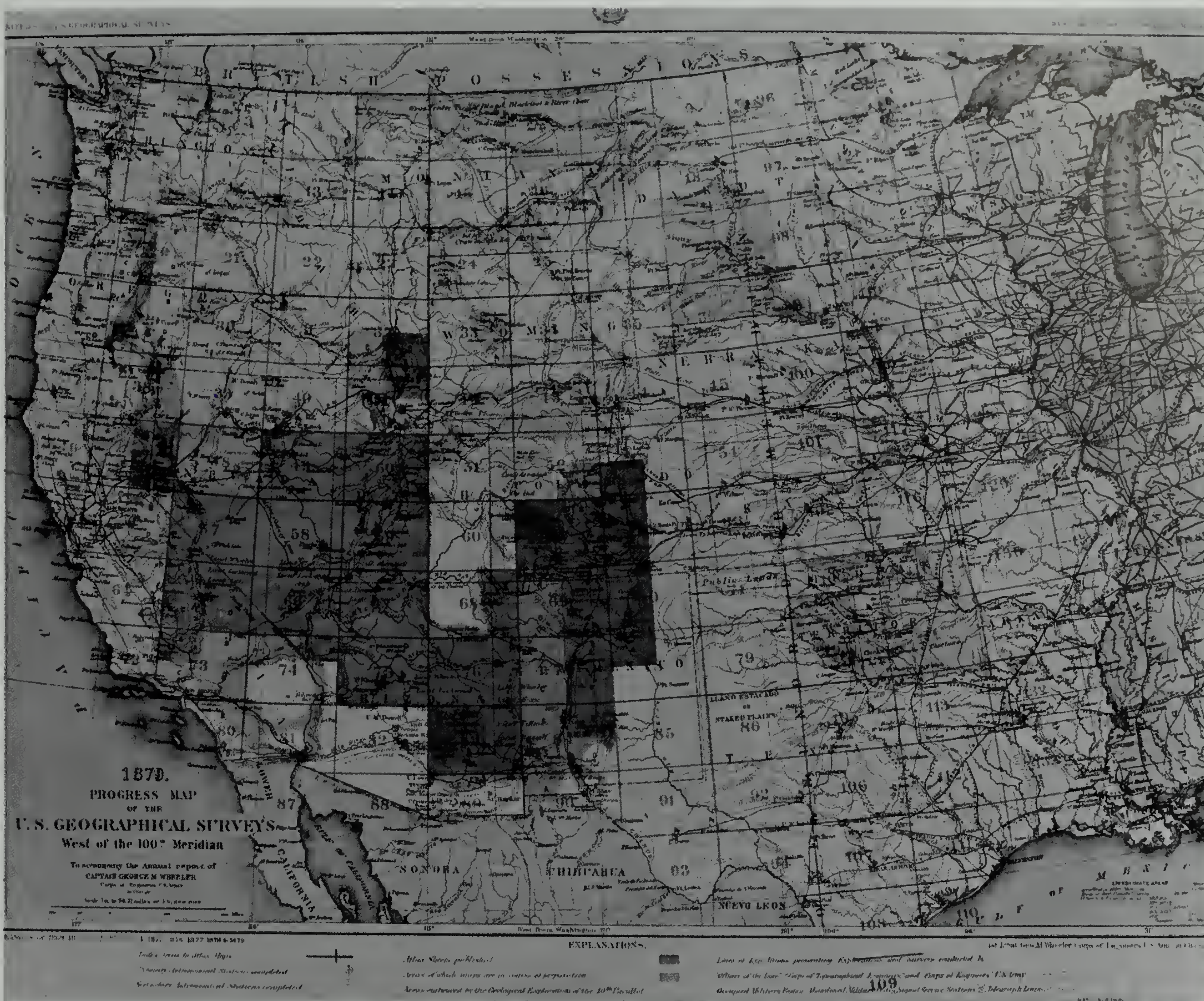
The Pacific Railroad surveys, instead of providing a conclusive report on the best possible route to the Pacific Coast, tended to deepen and intensify the pre-Civil War confusion and hostility of opposing viewpoints. Even though the work of the Engineers did not settle the issue, their tremendous efforts made a vast amount of new information available. The 13-volume *Pacific Railroad Reports* and other papers and maps were published and enjoyed wide circulation. Many believed that Lieutenant Gouverneur K. Warren's map of the Far West was the signal achievement of the entire effort.

While sectional issues grew more violent, the Corps of Engineers, from their office in San Francisco, continued to send out exploring parties. Late in 1857, Lieutenant Joseph Christmas Ives led an expedition out of San Francisco to explore the Colorado River. Ives and his men sailed from the Bay Area to the mouth of the Colorado River, where they reassembled the *Explorer*, a small steamboat built in Philadelphia and shipped in pieces around Cape Horn to San Francisco. Reaching Black Canyon, near where Hoover Dam now stands, Ives decided that he had reached the head of navigation. Sending some of his men down river with the *Explorer*, Ives struck out overland with a small group through the Black Mountains, the Cerbat Range, and reached the south rim of the Grand Canyon before ending his mission at Fort Defiance, Arizona. As a result of their work, Ives and his men determined the extent of navigability of the Colorado River, traced a path to the Mormon Road within the Great Basin, and became the first white men since the Spaniards to tread the floor of the Grand Canyon.

During 1858, Captain James Simpson undertook several expeditions through the Basin and Range country of the West. Later he was directed to search for a new wagon road route to California. In all, Simpson spent a decade in the Far West and explored and mapped as much or more of the area than anyone.

Even though the Topographical Corps had worked hard and achieved superior results in mapping the frontier, the War Department was uncertain about maintaining two separate engineering departments: the Corps of Engineers and the Topographical Corps of Engineers. As early as 1854, Secretary of War Jefferson Davis expressed doubts relative to retaining a separate organization for the Topographical Corps. In the summer of 1854, Secretary Davis initiated steps which ultimately dissolved the Topographical Corps as a distinct unit. At that time, he appointed Captain A. A. Humphreys to supervise the newly created Office of Western Explorations and Surveys. Under Humphreys, the new office not only administered the railroad surveys, but also assumed responsibility for all western exploration and mapping projects formerly under the direction of the Topographical Corps. Moreover, Humphreys was accountable directly to Davis, thus bypassing Colonel John James Abert, Chief of the Topographical Corps.

Another evolutionary step taken by Jeff Davis was the establishment of the Pacific Wagon Road Office (The Pacific Coast



U.S. Geographical Surveys. West of the 100th Meridian, 1879.

Office of Military Roads) in San Francisco during the spring of 1855. In this case, however, the Wagon Road Office continued to function, officially at least, as a subordinate unit of the Topographical Corps. Finally, in the midst of civil war, the Topographical Corps and the Corps of Engineers merged in conformance with the Act of March 3, 1863.

Following the end of the Civil War, the Corps of Engineers continued to explore and map the Far West. In 1869 a decade of topographical and geographical surveys west of the 100th meridian were begun. Field work continued until 1879, under the overall direction of Lieutenant George M. Wheeler. The results were published in a series of reports and topographical maps that covered all of the Western United States. With the publication of these reports, the initial phase of mapping and measuring the trans-Mississippi region was completed. The work filled in the missing data of earlier exploration, clarified and corrected previous reports, and made available for general use a wealth of information regarding the

physical characteristics of the Far West, including all of the area within the San Francisco District.

The first separate Corps of Engineers office established within the San Francisco District was the Pacific Wagon Road office, opened under the supervision of Major Hartman Bache in 1855. As Secretary of War in President Pierce's cabinet, Jefferson Davis believed that the problems associated with military supply, the movement and protection of the hordes of settlers flocking to the region, and improved communications must be dealt with from an office located close to the scene of the action. During the summer of 1855, Bache sent out a party to locate a route between San Francisco and the pioneer settlements of Oregon and Washington. At about the same time, he ordered Lieutenant Derby to survey and construct a military road from Salem, Oregon to Astoria.

Also under the purview of the San Francisco office were military road projects from Fort Dalles to Fort Vancouver and from Fort Vancouver to Fort Steilacoom. In 1856, Lieutenant George Mendell was transferred to the Pacific Northwest to succeed Derby in the road construction work. That same year the first military road was cut over the Sierra Nevada Mountains to connect San Francisco with military and civilian outposts in Nevada. Two years later, much of the road from the Rogue River country of Oregon to San Francisco was completed. Before long, it served as the main stagecoach route from California to Oregon.

The coast of California, particularly the area from Monterey to San Francisco, had been traveled by the Spanish and Mexicans long before American acquisition. The mission padres, and later the ranchers, had cut roads from one place to another even before the Gold Rush of 1849. Hence, the need for new military and civilian routes was not as great near coastal California as it was in Oregon and Washington.

With this in mind, the War Department, in April, 1858, ordered the office of road construction transferred from San Francisco to Vancouver, Washington Territory. Then, the following year, the Secretary of War suspended road building because of lack of funds. With new appropriations in 1860, however, the construction effort was begun again. And with money available, Colonel F. W. Lander was able to complete a new road over the Sierras and through the Great Basin area of Nevada, which connected to existing routes to San Francisco.

Over the years, the Corps of Engineers, from their headquarters in San Francisco, supervised the construction of roads throughout all of the western states and territories. The significance of their contribution was summarized by W. T. Jackson in his benchmark volume, *Wagon Roads West*. Jackson recounted how the Corps of Engineers' road construction program helped both the mobile population flooding westward and the settlers already established. The Engineers' work opened the valleys to the farmers, the forests to the lumbermen, and the mountains to the miners. In fact, the roads were probably used more by the settlers to move the products of forests and fields than by the military.

Opposite page:
A pair of engineers survey a part of the rugged western landscape.

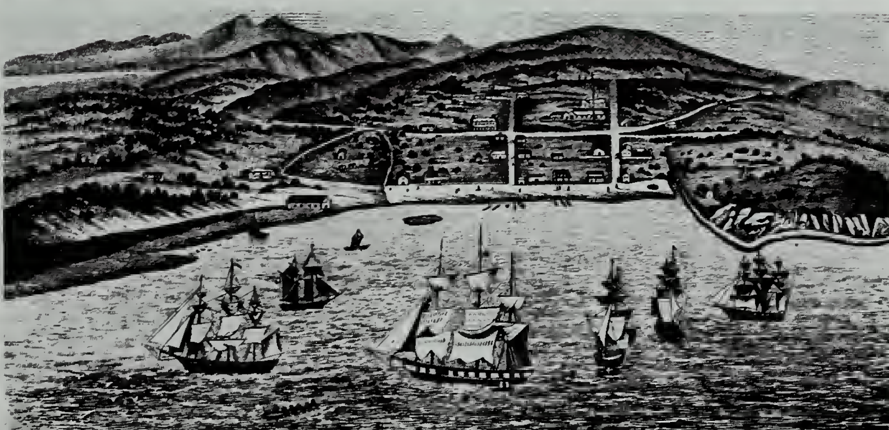
Harbor Development

While Army men and Army mules scraped dusty trails into recognizable road, other Corps of Engineers officers undertook the critical task of turning natural bays and open roadsteads into safe harbors. In 1866, a Corps of Engineers office for rivers and harbors was established in San Francisco with Major Robert S. Williamson as Officer-in-Charge. Williamson had a variety of responsibilities. For, in addition to his new duties relative to rivers and harbors, he was also involved in fortificaiton work, served as a member of the Board of Engineers for the Pacific Coast and was, as well, Engineer for the 12th and 13th Lighthouse Districts. This would be the pattern for many years for the Corps of Engineers officers who served in leadership roles within the San Francisco District. Assisting Major Williamson was Lieutenant William H. Heuer, a recent graduate of West Point. Both served under Major General Henry W. Halleck, appointed commander of the Department of the Pacific after the Civil War.

When established in 1866, the Corps of Engineers office for rivers and harbors had authority over the entire Pacific Coast from Canada to Mexico. Moreover, the significance of placing the office in San Francisco was twofold: it placed the work being done on the Pacific Coast on a plane equal with the rest of the nation, and San Francisco was recognized as the center for trade and industry in the Far West.

Since its acquisition by the United States, the configuration of the shoreline around San Francisco had undergone great changes because of man's activity. Initially, settlements on the peninsula had not been directly on the bay, but at the Presidio, overlooking the Golden Gate, and at Mission San Francisco de Assis. By the 1830s, the principal landing was at Yerba Buena Cove. It was here that the

The Sea Town and Port – Yerba Buena, San Francisco, California.



In this 1840s drawing hide ships are at anchor in Yerba Buena Cove. The view is toward Yerba Buena Island and the "Contra Costa" – today known as the East Bay Area.

San Francisco – 1846.

San Francisco – 1850.

Englishman William Richardson built his house in 1837. The next year, Jacob Leese established himself there. By 1846, the small village on the cove was known as Yerba Buena. It will be remembered that a party from the sloop of war, *Portsmouth*, raised the American flag there in July, 1846.

Yerba Buena Cove was shallow and, at low tide, transformed into a mud flat that extended out into the bay. The physical history of the waterfront of San Francisco is, in the main, the story of filling in the cove and the construction of wharves and buildings over filled areas to deep water.

By 1851 over 800 ships were in Yerba Buena Cove. Wharves were being built into the bay. Hundreds of hulks of abandoned ships would soon serve as warehouses, prisons and hotels.

Before gold was discovered, the hamlet was rechristened San Francisco and plans made to build wharves into the bay. The first impact of the Gold Rush nearly turned the settlement into a ghost town, but with the arrival of thousands of people headed to the gold fields, San Francisco found itself, practically overnight, a teeming city. Wharf construction soon passed into the hands of private companies who could more readily afford construction costs than could the town government.

The California Legislature first vested the authority to build, regulate and repair public wharves in the local government, but in 1863 passed a law whereby a Board of Harbor Commission would control the waterfront. Between 1877 and 1914, the board supervised the construction of a stone seawall along the established waterfront with piers pushing out into the bay from it. The development of port facilities posed a variety of problems, but they were solved remarkably well, given the natural handicaps that had to be overcome during the process of growth.

The rapid expansion of San Francisco and other ports within the bay reflected the ever-increasing numbers of ships utilizing the harbor. And while local agencies carried out port development, the Corps of Engineers began making the harbor a safer, more convenient anchorage. Their first efforts involved the removal (reduction) of Blossom Rock in 1867. The underwater hazard was discovered by Captain Frederick Beechey of the Royal Navy in 1826, and named after his 16-gun sloop, *H.M.S. Blossom*. The rock, located between Alcatraz and Yerba Buena Islands, was hidden some five feet below the bay's surface during low tide. It was in the track of shipping and proved to be a lethal barrier for years before its removal.

Major Williamson surveyed the situation, removed 69 cubic yards of stone and expended over $3,000 trying to determine the best way to get rid of the rock. He estimated that it would cost about $60,000 to do the job and requested that amount to be appropriated

for the next year. In 1868, $50,000 was appropriated, with an additional $25,000 being made available in 1869. After weighing the various plans submitted, Major Williamson approved that of Alexis W. VonSchmidt, a civil engineer, and his bid of $75,000 to complete the work.

VonSchmidt drilled a shaft into the rock, placed a charge of dynamite in the recess and set it off. The process was continued until the top of Blossom Rock was safely 24 feet below the surface. The work commenced in October, 1869, and was accepted and paid for on December 8, 1870. A detailed account of the project can be found in Major Williamson's report of April 25, 1871.

Major R. S. Williamson supervised the work of the district from his office at 509 Kearny Street, until he was relieved by Major George Mendell in 1871.* Mendell, like so many of his contemporaries, was an officer and gentleman of the first order and brought a rich background of knowledge and experience to the San Francisco District. Because he served for a long period in the district and contributed so very much to the welfare of the region, a word about the man seems in order before proceeding.

Mendell graduated from West Point on July 1, 1852. His first assignment was as an assistant engineer on the survey of the Northwestern Lakes from 1852-54. From there, he served on the staff of Major General John Wool, commander of the Department of the Pacific, during which time Mendell participated in the railroad survey from San Francisco to Fort Yuma. From there he was sent to the Pacific Northwest, where he fought Indians and supervised military road construction.

Mendell went east next to serve as a professor at West Point until the outbreak of the Civil War. During the war, he distinguished himself in a number of campaigns: Manassas, Petersburg, and Richmond. After the war, he returned to teaching at West Point. In January 1867, he was ordered to the West Coast, where he continued his brilliant career. Eventually he would rise to the position of Division Engineer for the entire Pacific Territory.

*Major Williamson went on detached duty to the 12th Lighthouse District.

This drawing was made by William B. McMurtrie, a draftsman for the U.S. Exploring Expedition in the spring of 1850. The view is San Francisco's waterfront at the height of the Gold Rush.

Map of the San Francisco waterfront comparing the area in 1848 and 1957. All of the area lying behind the six-mile seawall has been filled with old ships and assorted debris obtained from the hills of the city. Present-day excavations in the area often turn up unusual treasures from the past.

Illustrated supplement to the "San Francisco News Letter."

The blowing up of Blossom Rock in the Main Channel of the harbor of San Francisco on Saturday, April 23, 1870.

Henry Meigs, noted for his famous wharf, is also credited with founding the coastal redwood lumber trade.

Henry Meigs built an extensive wharf into the bay in the early 1850s. Meigs later absconded with city records and a sizeable portion of San Francisco's public funds. He turned up in Peru, where he became a railroad tycoon. His famous wharf remained until it was enclosed by the seawall in 1881.

After Blossom Rock had been reduced, Major Mendell contracted with J. N. Risdon on September 4, 1873, to take another hazard, Rincon Rock, down to where it would also be 24 feet below the surface. Work began in October, 1873, and by the end of June, 1874, 1,650 cubic yards of material had been removed. Work continued until April 7, 1875, when a disastrous explosion at the site took the lives of two employees and a number of bystanders. No work was accomplished from June, 1875, to May, 1876, because the contractor was enjoined by a State Court, at the suit of a creditor, from receiving any further payments from the government. Without the payments, he was unable to carry on the work. Finally, court suits, the inability of other contractors to complete the project, the danger of blasting due to the proximity of wharves and shipping, and a variety of related complications halted the effort. In accordance with requests from the State Harbor Commissioners, the job was accepted in its unfinished state in 1877. The commissioners believed the dangers to shipping by blasting outweighed any advantage that might be gained. Yet another serious threat to shipping was Noonday Rock, located about 33 miles west of the entrance to San Francisco Bay and some three miles from North Farallon Island. The contractor for the project was Edward Moore, who was supervised by Lieutenant Colonel C. S. Stewart and his assistant, Lieutenant J. H. Weeden. During the summer of 1875, holes were drilled deep into the rock and filled with 800 pounds of nitroglycerin! The resultant explosion was long remembered by those who witnessed it. When the charge was exploded, a solid column of sea water shot straight up for 600 feet before bursting, while clouds of saline spray were carried many hundreds of feet higher. A portion of the rock, estimated at 200 tons, was thrown to a height of 500 feet and then struck the ocean with tremendous impact. The total expenditure, to take the rock down to a depth of 47 feet below mean low water, was $24,999.75. During the course of the work, additional rocks were discovered in the vicinity, but it was recommended that they not be removed at that time.

From the earliest days of shipping on the Pacific Coast, Oakland Estuary was the favorite place to lay up for the winter. This picture, taken around the turn of the century, shows whaling ships on the right and large "downeasters" on the left. The latter once made the grueling 17,000 mile passage around Cape Horn. By the time this picture was taken they were used primarily in the coal trade between San Francisco and British Columbia, the lumber trade to Australia, and the seasonal trips to Alaska to serve the salmon canneries.

San Francisco quickly rose to pre-eminence as a result of the Gold Rush and its attendant shipping boom. With the passing years, however, the other settlements that grew up on the shores of the bay began to share in the wealth generated by maritime trade. Initially, their importance lay in the transportation of goods from their landings to and from San Francisco. Later, a pattern would develop whereby cargoes would come and go directly to ports around the bay rather than passing through San Francisco.

Oakland, lying on the *contra costa* (opposite coast), the east side of San Francisco Bay, was the first of these to receive attention by the Corps of Engineers. In response to the River and Harbor Act of 1873, the members of the Board of Engineers for the Pacific Coast were constituted as a special board of officers to make an examination, survey and plan for a harbor at the mouth of San Antonio Creek. Their report of February 2, 1874, recommended two parallel mid-tide training walls, 1,000 feet apart at the entrance; a tidal basin at the upper end; a canal eight feet deep and 300 feet wide connecting this basin with San Leandro Bay; a dam four feet above low water across the mouth of San Leandro Bay, designed to make it serve as an auxiliary tidal basin; and the dredging of a channel, between jetties, 100 feet wide and 6 feet deep at low water. The estimated cost was $1,800,000.

On October 14, 1874, a contract, supervised by Major Mendell and Lieutanant C.B. Sears, was signed with Daniel Sweeny to begin work on the north training wall. Sweeny failed to meet his contractual obligations and a temporary arrangement was made with another firm to carry on the work. Other operations begun at this time included the opening of a quarry at Yerba Buena Island, marking out the line of the north training wall by piles, a hydrographic survey of the harbor entrance and a survey of the canal route that was to connect San Antonio and San Leandro estuaries.

By the spring of 1878, more than $350,000 had been made available for the north and south jetties, dredging and related work. Mendell's report for that year drew attention especially to the dredging between the jetties to meet the needs of the rapidly increasing commerce utilizing the harbor. In the same report, he pointed out that

Trains meet square riggers at the Oakland Long Wharf. The wharf, end of the transcontinental railroad, was built by the Central Pacific Railroad to bring passengers and freight to deep water. The two-mile structure was finished in 1871.

The Oakland Long Wharf served ocean-going as well as coastal shipping until 1918. After 1882, however, the wharf was utilized for freight exclusively, while passengers were landed at the new Oakland Pier at the end of the Oakland Mole.

the commercial benefits derived as a result of the harbor improvements were quite substantial. For a long period, in fact, officers of the San Francisco District were concerned that they might not be able to keep up with the Bay Area's pace of development. In the case of Oakland, however, private interests threw up road blocks that added to the challenges presented to the engineers by natural conditions.

By the end of 1869, transcontinental trains of the Central Pacific Railroad (Southern Pacific) began bringing passengers and freight to Oakland. Having gained control of most of the Oakland waterfront, the company wanted to extend its dominion to Yerba Buena Island. The railroad group planned to level the land, fill in adjoining shoals where Treasure Island now stands and then build a causeway to Yerba Buena from Oakland, making the island the western terminus of the transcontinental railroad.

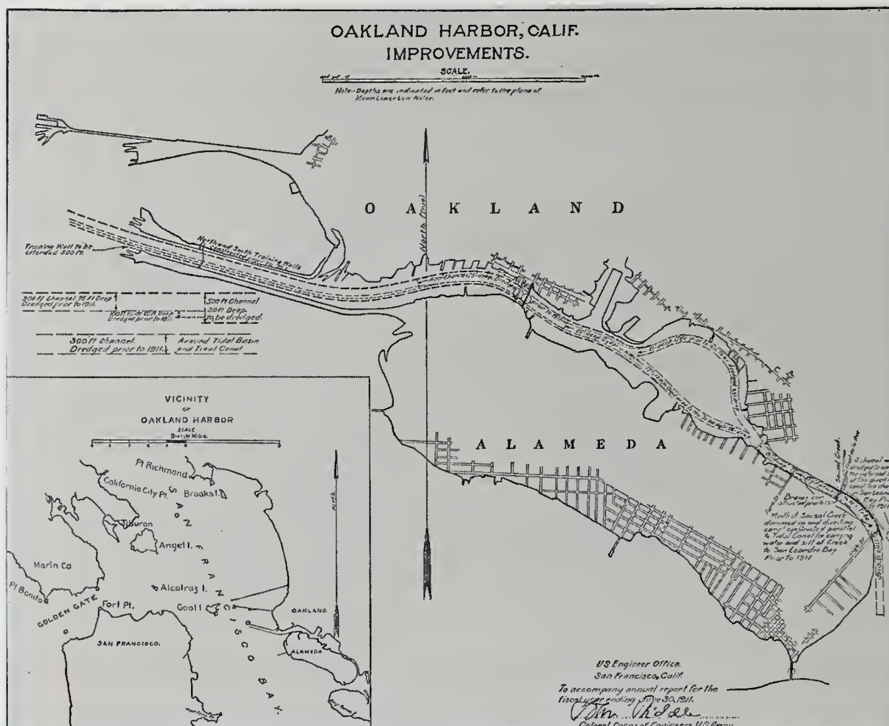
The California State Legislature agreed to give the railroad the shoals north of the island and a 250 foot-wide strip of bay bottom from the shoals to the mainland. Following this, a bill was introduced in Congress to give Yerba Buena Island to the railroad. At this point, San Franciscans became alarmed over the possibility of their city becoming a bypassed suburb if the Central Pacific were allowed to set itself up in a railroad-owned industrial city in the middle of the bay. The San Francisco Chamber of Commerce reacted by sending a top-level committee to Washington, D.C. As a result of the committee's slashing attack on the bill, the island was withheld from the railroad.

Having lost the opportunity to spread their holdings to the mid-bay island, the Central Pacific consolidated its position in and about Oakland. By 1871, they pushed their Oakland Long Wharf two miles into the bay to reach deep water. Later the company extended the wharf still further over the shoal area nearly to Yerba Buena Island. Before long, using one alias or another, the Central Pacific gained a virtual monopoly of the Oakland waterfront.

The Corps' plans for improving the harbor at Oakland came to a standstill in 1878 because the Oakland Waterfront Company would not execute the necessary release of title to the bed of the estuary that it claimed as its own. The Oakland Waterfront Company, as an arm of the railroad, simply didn't want the competition that improved harbor facilities would bring. For its part, the Corps of Engineers, under the leadership of Mendell, suspended operations and returned the $60,000 appropriation made for the year 1879 to carry out the planned work. Finally the matter was turned over to the U.S. Attorney General's Office for resolution.

On June 28, 1880, the Attorney General decided that the United States already had full rights to the land in question, without cession from any parties. On October 5, 1880, a contract was signed with Dennis Jordan for stone and foundation work to raise the jetties, thus marking the beginning of renewed efforts on the part of the Engineers to create a deep water harbor at Oakland. In September, 1883, condemnation proceedings (*U.S. v. Crooks*) for the tidal canal land were completed, allowing this phase of the improvement to be completed.

1911 map shows Corps improvements at Oakland Harbor.



By the summer of 1898, vessels drawing 19 feet could pass from the bay to Oakland Harbor at ordinary high water. Prior to Corps of Engineers improvements, boats drawing but six to eight feet water could pass over the bar at high tide and then only under the careful handling of experienced captains. Up to June 30, 1900, almost $2 million had been expended on the project, which resulted in a channel 300 feet wide and 20 feet deep at low water from San Francisco Bay to Webster Street Bridge; a pair of stone jetties, one 12,000 feet long and another 10,000 feet, built into the bay; a tidal basin about two feet deep at low water, covering about 300 acres; a tidal basin channel six feet deep at low water, 200 feet wide and almost a mile long, a portion of the tidal canal being excavated both at the Oakland and San Leandro ends; and a bridge over the tidal canal at Park Street between East Oakland and Alameda. Bridges were also being built over the canal at High Street and Fruitvale Avenue. A diverting canal for Sausal Creek, to prevent deposits in the tidal canal, was also being constructed at this time.

In addition to the substantial work at Oakland, San Francisco Office personnel were completing other smaller navigation projects around the bay during the closing quarter of the 19th century. North of the bay proper, Petaluma was playing a vital role in the development of the region. From an early day, the town was important as a place of transshipment. Located at the head of navigation on Petaluma Creek, Petaluma began as a shipping point, with stage and freighting lines running from the town to Santa Rosa, Healdsburg, Tomales, and Sonoma.

Petaluma in 1855 was the head of navigation on Petaluma Creek. It was an important shipping port for local goods as well as serving Santa Rosa, Healdsburg, Sonoma and other towns.

By 1879, Petaluma was a flourishing town of more than 4,000 inhabitants, surrounded by fertile agricultural land. The San Francisco

and North Pacific Railroad reached Cloverdale, about 50 miles above Petaluma, and had its terminus at a place called Donahue on the creek, about eight miles below the town. The little city was prosperous, and did a large trade in fruit, dairy products, eggs, wheat, hay, potatoes, corn, wool, firewood, lumber, livestock, lime, brick, paving blocks and a variety of general merchandise. The commerce of the modest port was carried on by a steamboat which made daily trips to San Francisco and by a regular fleet of about thirty schooners, averaging 50 tons each. Because of the condition of the creek at that time, however, passengers were landed below the town and then sent overland by wagons. Freight had to be transferred to a small steamer and then taken up to Petaluma during periods of high tide.

In compliance with directions contained in the River and Harbor Act of March 3, 1879, Lieutenant Colonel Mendell completed a survey of Petaluma Creek over the summer of that year and then sent a favorable report to Congress. He pointed out that Petaluma Creek was one of several tidal channels which extended from the marshland along San Francisco Bay and wind, by way of a tortuous course of sharp bends through the interior, a number of miles to a point where the marsh adjoins the upland. He noted that all the streams were navigable for small vessels and afforded easy communication with San Francisco.

Mendell believed it was wrong to class the channel as a creek, when in fact it was really a tidal estuary, trumpet-shaped, the wider end at the mouth in San Pablo Bay dwindling to a narrow channel at its upper extremity where it meets the town of Petaluma. His report indicated that the channel was some 15 miles in length and about a mile across at its mouth, but only 60 feet wide at the town site. Mendell, letting his imagination wander a bit, wished that it was

The Rambler *was typical of steamboats of the 1850s and 1860s that negotiated the sharp turns of Petaluma Creek. In this 1860 woodcut, passengers volunteer to help the crew push the boat off a mud bank – a common hazard experienced by boats plying the meandering tidal streams which enter San Francisco Bay.*

possible to pick up the estuary and set it down again in a reversed position, thereby creating a reservoir at Petaluma. That not being possible, at least not in 1879, he felt that if the channel was to be kept navigable, dredging was required. More than that, the impossible crooked channel must also be straightened. Even without improvement, the steamer *Pilot* had carried more than 13,000 passengers on the creek to and from Petaluma during 1879.

Once the riparian owners along the creek agreed to release the necessary land on which to place the excavated material, work was started. The original estimate for improvement amounted to almost $26,000. It called for three cutoffs to be made and dredging sufficient to provide three feet of water to the town. During 1880, two of the cutoffs were completed and some dredging begun, which, according to Mendell, really enhanced the commerce of the area. The improvement, as outlined in the original report and estimate of December 2, 1879, was completed on May 2, 1884. The three cutoffs had been made and the entire channel dredged to three feet at low water, except for a small stretch at the upper end where the depth was made two feet. The total cost of the project was $27,657. Over the years, however, additional maintenance dredging was done to retain the advantages achieved earlier.

The next river valley east of Petaluma was, and is, dominated by the Napa River. The first American to settle in the valley was George C. Yount, a native of North Carolina who came west in 1831 as a member of the well-known Wolfskill party. Yount went to the Napa Valley in 1835 and the next year the first land granted by the Mexicans in the region became his — Rancho Caymus, 11,814 acres in the heart of the beautiful valley. In 1843 he was joined by Dr. Edward Turner Bale, an English surgeon who had been practicing in Monterey. He married a

Four scow schooners moored at Napa are taking on lumber. Napa stands at the head of navigation on the Napa River, a sluggish stream that meets San Pablo Bay at Vallejo.

Redwood City, shown here in 1865, was a busy South Bay port doing a brisk business in lumber and shingles.

niece of General Vallejo and moved to the valley, where he lived the life of a country gentleman. His well-managed acres were fruitful and he amassed a comfortable fortune. His gristmill, built in 1842, ground meal for valley residents for 25 years and still stands today near St. Helena. Over the years that followed American acquisition of California, settlers moved into the Napa Valley and, before long, the area was a rich agricultural region. Surprisingly, the vineyards and wineries for which the valley is now famous date back only to the 1860s.

Like its sister settlement, Petaluma, to the west, the town of Napa was the head of navigation for a meandering stream that met the bay at Vallejo and the Carquinez Strait. The town was, as well, the trade center for a considerable part of the north bay region and a transhipment point for goods coming to and going from the area. Before improvement by the Corps of Engineers, the river had an average low-water depth of five feet with exception of the bars, where the depth was reduced to less than a foot on the crests. The ordinary rise of the tides was about five feet, allowing vessels drawing no more than four feet to navigate the river to Napa. The Engineers proposed to improve the situation by dredging the bars, cutting off the worst of the sharp bends to achieve a channel 75 feet wide and four feet deep at mean low water, and by removing the dozens of snags and other obstructions that often hindered river traffic.

The Engineers began work on the project in 1889 and continued dredging and straightening the river up to the turn of the century. By June 30, 1898, more than $21,000 had been spent on the improvement, rendering navigation easy for the river boats and schooners that plied the stream. In 1898 alone, more than 95,000 tons of produce and merchandise were carried on the river, in addition to thousands of passengers.

During the same period, work was undertaken to improve the small harbor facility at Redwood City, located on the bay a few miles south of San Francisco. Redwood City began as a port for the shipment of redwood lumber. Redwood Creek, running through Rancho de las Pulgas where Redwood City now stands, and emptying into a slough or arm of the bay, formed a natural shipping point (embarcadero).

District Engineer 1895 - 1896
Capt. Joseph E. Kuhn

Lumbering became an important industry wherever redwood trees grew and there were many of these in the mountains within a few miles of the town. Shipment of lumber from the Woodside and Searsville mills began in 1850 and, before long, the Embarcadero became a busy wharf. At about the same time shipbuilding was begun and a number of schooners were launched there that same year. Also established at an early date were wagon making and blacksmithing as important adjuncts to the business of hauling the products of the mills to the Embarcadero. Once loaded with dressed lumber and shingles, the sloops and schooners left the wharf and threaded their way down the meanderings of Redwood Creek to the open bay on their way to the lumber yards of San Francisco. This, then, was the nucleus around which the city and harbor developed.

A preliminary examination of Redwood Slough/Creek was carried out by the San Francisco District, the report dated November 27, 1882. Their report recommended dredging approximately 40,000 yards of material from the channel to provide a depth of seven feet at high water. The estimated cost of the work was placed at $15,400. By 1884, only $3,000 had been appropriated, so the work was deferred pending additional funds. Improvement of the harbor finally got underway in April, 1887, with the use of a newly completed government-owned dredge. By August of that year, 15,500 yards of material had been removed, resulting in a channel 50 feet wide, three feet deep during periods of low tide and some 6,000 feet in length. Work on the creek and harbor continued from 1884 through 1890, during which time $23,400 was spent and more than 100,000 yards of material dredged from the creek and harbor. In October, 1896, the Engineers submitted a survey report opposing the spending of additional funds for deepening the small upper slough because, in their opinion, the only parties to benefit would be the owners of a lumber yard and a tannery. In the meantime, Redwood City had constructed a wharf on the larger slough at the entrance to the smaller one and had linked the two by a planked roadway.

Early photograph of the waterfront at Redwood City.

The scow schooner Annie L. *tied up in Alviso Harbor near the chicken shell dredger of the W. B. Ortley Co.*

The River and Harbor Act of June, 1902, provided for further improvements of the stream in accordance with a plan drawn up in 1897 — the dredging of the channel to five feet at low water all the way to the town's main wharf. This work was completed on July 14, 1903. As it had at other locations, the Corps of Engineers' work at Redwood City improved the opportunities for increased maritime trade. During 1903, shipping increased over the previous year, the aggregate being over 21,000 tons. The principal cargo leaving the port consisted of tannery supplies, tannery products and salt.

If one follows the natural curvature of San Francisco Bay to the south and east, several creeks are crossed before arriving at the southern end of the bay. Here, one comes to Alviso Harbor, the southernmost port on the bay. Originally the place was known as El Embarcadero de Santa Clara de Assis, and was the head of a navigable slough that extends south from San Francisco Bay. In the early mission days especially it played a very important part in the life of the settlers at Mission Santa Clara and the pueblo of San Jose. Following secularization of the mission in 1836, Yankee ship captains opened up an extensive trade with the dons who owned the vast ranchos bordering on the bay. Every rancho had its embarcadero. Among them, the Embarcadero de Santa Clara was one of the foremost. Richard Henry Dana, in his book *Two Years Before the Mast*, reported that the place did a greater business in hides than most any other in all of California. Indians in large boats would bring the hides down from the mission on the Guadalupe River, unload them at the embarcadero, where the river meets the slough, and then return to the mission with trade goods.

In 1838 Ygnacio Alviso, a construction worker at the mission, was granted Rancho Rincon de los Esteros (Ranch of the Estuary). He moved to and settled at the embarcadero in 1840 and soon after the landing was known as Alviso.

The development of the quicksilver mines at New Almaden, in 1845 and for many years after, played a large part in the shipping

District Engineer 1896-1901
Col. Charles R. Suter

industry of the small port. With the discovery of gold in 1849 and the rush that followed over the next few years, things boomed at Alviso. Trade increased so substantially that a steamer was run from San Francisco to Alviso and the first warehouse was built there during 1849 and 1850. This was also the period in which the state capital was located at San Jose. It is interesting to note as well that a one-way fare on the steamer was $35 per passenger to Alviso and $10 from the landing to San Jose.

Alviso enjoyed its greatest period of development from 1850 to 1861. But, as happened at so many other pioneer ports of the bay, the railroads arrived in the mid-1860s and began undercutting shipping charges, thus diverting trade away from the settlement. Even though the advent of the railroad did much to dampen its prosperity, Alviso continued to do a declining export business in fruit, farm products and general merchandise for many years.

As the century began to draw to a close, residents of the area beseeched Lieutenant Colonel William Heuer, District Engineer, and his staff to examine the area with an eye toward improvement. It was the belief of at least some of the local people that with a better harbor, trade and prosperity would return to the settlement. The Engineers conducted a survey during the summer of 1890, and submitted their report dated October 29, 1890. After looking into the situation, it was their considered judgement that the unimproved channel was adequate for the existing commerce.

Disappointed, but not defeated, the local residents, through their Congressmen, were able to get another survey authorized in 1892. Once again, Heuer carried out an examination of the waterway and submitted an unfavorable report. Even though the Congressionally-ordered surveys of 1890 and 1892 stated that the slough was unworthy of improvement by the federal government, the residents of the south bay area weren't to be put off. Finally, in 1896, the District engineers prepared and submitted a plan for a dredged

A variety of vessels await cargo at Alviso Harbor.

channel seven feet deep at low water, 60 feet wide generally, 80 feet wide opposite the wharves, and for a V-shaped basin to be dredged in front of the village so that boats could turn around. The engineers estimated the entire project would cost about $48,000. In March, 1899, Congress appropriated $48,000 to carry out the work as described.

Bids for dredging the slough were invited and opened on August 10, 1899. Edward V. McCann of San Francisco was the low bidder, so on September 8 a contract was signed for him to do the work for six cents a cubic yard. Apparently McCann was rather an inventive fellow, for he built a machine of novel design with which he proposed to complete the project. Unfortunately for Mr. McCann, his masterpiece was an utter failure.

Bids were again called for and this time A. C. Aiken, also of San Francisco, was awarded the contract for more than double the per cubic yard price of the previous contractor. Aiken began the work using a small clamshell dredge on August 23, 1900, but progress was quite slow. In November, a suction dredge was put to work, but it too proved incapable of dredging the hard material that was encountered. This was in turn replaced in December by a new, more powerful machine, which completed the job on June 19, 1901.

During the year 1900, a single steamboat of 295 tons carried 11,000 tons of freight to and from Alviso. In addition, a few scow schooners carried some general produce from the town's wharves. But even with the improved channel, shipping tended to taper off. Heuer reported that during 1901, the commerce of Alviso slough was small and unimportant, and consisted principally of vegetables shipped to the San Francisco market. A small steamer, the 192-ton *San Jose* ran regularly to Alviso during a portion of that year, carrying freight and passengers, but a statement as to the specific amount of business done could not be obtained for the Corps' records. Total expenditures to June, 1901, were $27,500, which left an unexpended balance in excess of $20,000 for further improvements.

By the turn of the century Alviso, a once lively port and terminus of sailing vessels and steamboats, experienced a continuing decline in maritime business. The coming of the railroad helped dampen the prosperity of this southernmost port on the bay.

Colonel Heuer inspected the completed project, noted that the hoped-for increase in commerce hadn't been realized and suggested that no further work be done and that the excess funds be returned to the treasury. On June 13, 1902, however, Congress made the unexpended balance available for extension and further improvement of the channel heretofore made. A survey made in 1902, about 14 months after the completion of the work, showed a filling in the channel of upward of 100,000 cubic yards of material, which was about 60 per cent of what had been previously dredged and most of which was traced as coming in from the old Guadalupe River, which enters the slough near Alviso.

The dredging done in 1900-01 throughout the channel extended generally to hardpan and, in the upper half, the channel was dredged from bank to bank, which were from 60 to 80 feet apart. To dredge deeper would prove very expensive and a wider channel could not be obtained without cutting away one of the banks. In the lower half of the slough, the channel was already more than adequate for commerce and navigation. When these facts were reported to the Secretary of War, with his approval, further work was deferred. In 1904, however, residents of the little port complained to their Congressman, who in turn was able to gain approval for further improvement. A resurvey was made in April, 1904, which confirmed the results of the 1902 study and showed an additional filling since that time.

District Engineer Col. William H. Heuer
1901-1907 1917-1919

Heuer reported further that no material increase in the volume or character of commerce resulted as a consequence of the improvements. In fact, the steamboat servicing the region stopped running there, not due to lack of water but because of lack of business. So, even though the Engineer officers in charge of the project advised against further work, Congress, in June 1902, made the funds available to deepen and widen the stream. In October, 1904, bids were opened for redredging the slough, the channel and the turning basin. Work began on January 30, 1905, and was completed on June 5 of that year. But even after the additional work was finished, maritime trade at Alviso steadily declined. The railroad had secured a

monopoly on the shipment of goods from the Santa Clara Valley and didn't even have to lower its rates to ensure that Alviso wouldn't offer any competition.

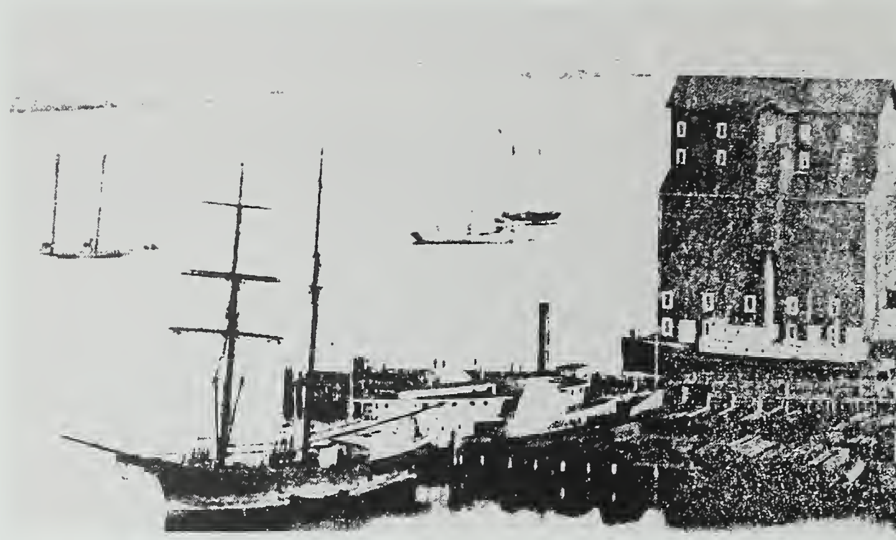
Four other small ports on the bay petitioned the district office for examinations to be completed with a view toward improvement at government expense. In 1896, and again in 1899, preliminary surveys were carried out on Suisun Creek, an 18-mile long Suisun Bay tidal estuary. The Engineers' reports of 1896 and 1899 concluded that the unimproved channel was sufficient and, besides, the vessels using the stream could hardly compete with the railroad, anyway. On three separate occasions, ship companies were bought by the railroad. When a company refused to sell, the railroad, with its facility at Vacaville, simply cut their rates so low that the steamers couldn't compete.

In the case of South San Francisco, Heuer refused to submit a favorable report because it was his fixed opinion that the only beneficiaries would be a few commercial interests located near this small community of some 1,200 persons. Basically the same findings were reported about proposed improvements on Sonoma Creek, located just east of Petaluma Creek. Too few would benefit at the government's expense.

Heuer's reasoning for submitting a negative report on Belvedere Harbor took a different tack. In his report dated February 26, 1903, he stated that with commercial piers and deep water next door at Tiburon near Raccoon Strait, there was no justification to improve the harbor at Belvedere. Further cause noted by Heuer was the fact that Belvedere was principally a pleasure craft haven and exported nothing. On the other hand, when the engineers believed that maritime traffic warranted government assistance, they were ready to do all they could. Such was the situation relative to the San Pablo Bay channel.

All of the waterborne traffic from Sacramento, Stockton and the other inland ports, as well as Vallejo, Napa and Mare Island had to pass through the Carquinez Strait (Straits of Karquines) and San Pablo Bay to reach San Francisco. Hundreds of vessels carried millions of dollars worth of goods and thousands of passengers through this water course every year. Hence, it was critical that it be improved and maintained.

By the mid-1800s huge grain wharves lined some five miles of the shoreline of the Carquinez Strait. Nearly half of the grain ships leaving San Francisco Bay for foreign ports were loaded at facilities on Carquinez Strait. Pictured, Port Costa Warehouse and Dock Company had a capacity of 70,000 tons of grain and was equipped with railroad lines and moving-chain elevators. A dozen ships could load simultaneously.



Like the nearby ports on the Carquinez Straits, South Vallejo was also an important grain loading port. This 1870 view looks northwest up the Napa River. Mare Island Navy Yard is seen on the far shore.

The San Francisco District submitted its preliminary examination reports on March 29 and September 6, 1899, with a plan for improvement at an estimated cost of $381,000 for the original work and a proposal for $16,000 annually for maintenance of a channel between the Straits of Karquines and the Golden Gate, by way of Point Pinole, Point Wilson and Lone Tree Point. On June 13, 1902, Congress appropriated $100,000 for the project and authorized continuing contracts for the completion of the work to a limit of $381,000. The improvement was comprised of a channel 300 feet wide, five miles long and 30 feet deep during periods of mean low water. Bids for doing the work were invited and opened on October 1, 1902. All of the work was supposed to be done by July 4, 1905. The contractor, Rudolf Axman, began work on February 24, 1903, but because of inadequate equipment, made little progress. Heuer grew frustrated with the poor performance and reported to the Chief of Engineers that it might become necessary to apply drastic measures to Axman to enforce the requirements of the contract.

After ten months of dredging, the cut made was about 8,000 feet long, from 60 to 120 feet wide, and generally 31 feet deep. As this represented less than 20 per cent of the requirements, the contract was annulled in December, 1903. The work was subsequently readvertised, and awarded to North American Dredging Company in June, 1904. The firm used a large clamshell dredge on the work up to November 1, 1904, when it was found necessary to employ another dredge to maintain the terms of the agreement. All of the material dredged was put into large dump scows and towed to deep water near Point San Pablo, at the junction of San Francisco and San Pablo Bays, and there deposited in from 60 to 80 feet of water.

The two dredges worked continuously until January 1, 1906, when the entire channel had been dredged to a depth of more than 30 feet at low water. It was soon discovered, however, that some filling had taken place in the first 120 foot wide channel made through the shoal and it was necessary to keep one of the dredges at work until February 10, 1906, at which time the contracted work had been

completed. Up to that time, just shy of $300,000 had been spent to improve navigation through the designated area.

Even though the officers of the San Francisco District dedicated a great deal of time, energy and money to harbor development around the bay, they maintained, as well, a careful vigil on the needs of navigation within the main part of the bay itself in and around its chief port, San Francisco. As early as 1878, the Board of Engineers began studying surface and sub-surface currents in San Francisco Bay for the dual purposes of navigation and harbor defense. Then, in 1881, in response to a Congressional request dated June 12, 1880, the Corps made a study of the entire tidal area of the bay to determine its general condition and the changing tidal patterns. Yet another concern of the San Francisco District was the effects dredged material was having on the bay's environment when deposited within the bay itself. Funds were requested in 1884 to investigate the results of this practice. Prior to 1882, approximately 5.6 million cubic yards of material were dumped back into the bay by the dredgers, below the high-water mark. After 1882, the government began placing spoils above the high-water mark. Besides the dredged material being put back into the bay, concern was growing relative to shoaling taking place because of hydraulic mining. During 1886-1887, the San Francisco District, in cooperation with the Coast and Geodetic Survey teams, examined the entire area from the Sacramento/San Joaquin Delta to the Golden Gate. By 1888, almost $9,000 had been spent on the hydrographic survey and for the preparation of maps and charts by the district.

In August, 1886, the Corps of Engineers acquired responsibility for establishing harbor lines in San Francisco Bay and waters adjacent to it.* Under special orders dated October 11, 1888, a Board of Engineer Officers submitted a report on the waterfront of San Francisco at Mission Rock and on the waterfronts of Port Costa, Martinez, Benicia, Vallejo, South Vallejo and Mare Island Naval Shipyard. By 1890, harbor lines had been established for all of these locations.

Natural erosion, debris brought down the rivers to the bay and the effects of tidal action all combined, caused Mendell's concern to grow relative to the depth over the bar at the entrance to the Golden Gate. So, just two years after the harbor lines were fixed in the bay, Mendell conducted a preliminary examination of the entrance to the harbor. His report of July 7, 1892, indicated that there was still sufficient water over the bay to afford passage to deep-draught vessels. Hence, he recommended no improvement at that time.

During the years that the various current and tidal surveys were being conducted and the harbor lines laid out, it was discovered that a number of underwater rocks posed threats to the ever-increasing commerce of the bay. During 1894, preliminary examinations were carried out to determine the relative danger to shipping and the probable cost of reducing: Sunken Rock, Mile Rocks, Arch Rock,

*Harbor lines are those that define the limits of a harbor and to a degree determine the flow of traffic within the harbor.

A final survey is made in 1900 prior to blasting Shag Rock.

Noonday Rocks, Blossom Rocks, Two Mission Rocks (also known as Mission Rock and Sonoma Rock), Shag Rock, Anita Rock, Invincible, Whiting Rock and Fifteen-Foot Rock, known as the Brothers.

It was determined that Sunken Rock, located off Fort Point, constituted no immediate danger to navigation. An unfavorable report dated October 11, 1894, was also submitted on Mile Rocks, in that it stood some 20 feet above the water, and served as a warning beacon in an area of other sunken rocks and an 18-foot reef, making its removal more dangerous than leaving it in place.

All of the others received favorable reports for improvement in that they either were in the paths of ferryboats, commercial transports or obstructed the entrance to the waterfront. Mendell recommended further study of these to determine the cost of the work required to increase the depth over them.

In 1898, Colonel Charles R. Suter of the district office submitted a survey report on removal of Shag Rocks No. 1 at an estimated cost of $76,000, and No. 2 at a cost just less than $60,000. Anita would cost over $250,000; Arch approximately half a million dollars; Blossom $92,000; Mission Bay $112,000; and Sonoma $10,000. The total price of the improvement would come to $1,106,300. All would be removed to a depth of 30 feet below mean low water except Mission Bay Rock, which would be 26 feet, and Sonoma Rock, 25 feet. The project called for the removal of a total of over 55 thousand cubic feet of material.

The River and Harbor Act of March 3, 1899, provided an aggregate total of $500,000 for the removal of Arch Rock and Shag Rocks 1 and 2. All were to be reduced to 30 feet below mean low water, according to the district's plan of October 13, 1897. Proposals for removing these rocks were advertised for and bids were opened on August 12, 1899. It's interesting to note that nine firms submitted bids for the work. And, while the majority were from San Francisco, others were proffered from as far away as Chicago, Los Angeles, and Buffalo, New York, and ranged from a low of $253,000 to $444,000. Rudolf Axman from Los Angeles was the low bidder, and his signed contract was approved September 14, 1899. He began the work on December 3 of that year.

As was related earlier, the removal of underwater rocks was and remains extremely dangerous work. But more than that, it was a procedure seldom viewed by other than those directly involved. With this in mind then, a recounting of how Shag Rock No. 1 was reduced will serve to illustrate the basic procedures employed with the removal of rocks generally.

A plant consisting of drills, boilers, charges, towboat and other equipment was purchased and brought to the work site. A timber mast, consisting of four pieces of squared timber, each 12 by 12 inches, bolted together, and 68 feet long, bolted together, was stepped on the rock and held in place by four guy wires (cables) anchored in the bay 300 to 400 feet distant. On and around this mast, suspended from its top, was a platform 25 feet wide by 140 feet in length. The platform, hung seven feet above the water, could swing in a horizontal plane about the mast as a pivot. The various steam drills and related equipment needed to bore holes in the rock were placed on the platform. Quarters and eating facilities for the workmen and the boilers that provided the steam for the drills were placed on a large scow and moored near the drilling platform.

In January, 1900, several surface charges of nitrogelatin (containing about 90 per cent nitroglycerin) varying from 25 to 75 pounds each were placed on the rock and fired. This resulted in about 30 yards of rock being broken and removed. The next month, drilling was undertaken utilizing 3-3/4-inch drill bits. A half dozen holes were bored to below the 30-foot grade line, but the sand rock was so soft that the bits would jam and, when withdrawn, the material would fall back into the holes. To correct this problem, iron casings had to be inserted into most of the drill holes. In some places, however, the rock material was so hard that the drills didn't penetrate at a rate of more than one foot per hour.

A few more surface charges of gelatin were placed and fired, followed by the placement of a combination of giant powder and gelatin in one of the drill holes, which was then exploded. None of these blasts accomplished much. The contractor then started to drill holes 10 inches in diameter, which had to be cased for a depth of 5 to 10 feet below the surface. All of the holes were bored vertically and,

The Napa City, *built in 1891, was representative of the small bay freighters that brought agricultural products from outlying ports to San Francisco.*

Explosion of surface blast on Shag Rock, No. 2. San Francisco Harbor. September 5th, 1900. Quantity of explosive: 21,169 lbs. of nitro-gelatin. Height of column: 1,120 ft.

when completed, their bottoms were from two to seven feet below the 30-foot grade plane. The drilling was finally completed on April 24. By that time, nine holes 3-3/4 inches in diameter and two dozen 10 inches in diameter had been drilled into the rock. The smaller holes were ignored, but the larger were cased above the high-water level and connected to each other by wooden beams to prevent swaying in the violent storms.

On April 25, the contractor began to dismantle the drilling platform and to load the 10-inch holes with nine inch by 18 inch cylinders containing a total of over 16,000 pounds of nitrogelatin. Each charge had four electric fuses, each fuse surrounded by a stick of dynamite. Then an insulated wire was led to a barge about 6,000 feet distant and connected to a dry Mesco battery of 120 cells, furnishing an electro-motive force of 164 volts.

The entire charge was set off at 3:04 p.m. on April 30, 1900. The shock was almost imperceptible, but suddenly a shaft of water rose 996 feet into the air in just under nine seconds. Its greatest diameter was calculated to be approximately 500 feet. None of the shattered rock was visible to the unaided eye, but photographs examined closely

Hole No	Size of Hole Diameter	Depth of Water from Zero to Surface of Rock	Depth of Water from Zero to Bottom of Hole	Depth of Hole Drilled in Rock	Depth Drilled below Grade
8	10"	+ 2.9	34.0	36.9	4.0
10	"	+ 2.9	33.5	36.4	3.5
11	"	2.1	37.0	34.9	7.0
12	"	18.1	33.0	14.9	3.0
13	"	12.6	33.0	20.4	3.0
14	"	2.1	37.0	34.9	7.0
15	"	7.6	37.0	29.4	7.0
16	"	8.1	36.6	28.5	6.6
17	"	1.0	36.0	35.0	6.0
18	"	19.6	36.0	16.4	6.0
19	"	2.1	34.0	31.9	4.0
20	"	+ 2.9	35.6	38.5	5.6
21	"	15.1	36.0	20.9	6.0
22	"	18.6	36.5	17.9	6.5
23	"	25.6	36.6	11.0	6.6
24	"	15.6	36.0	20.4	6.0
25	"	26.6	36.5	10.9	6.5
26	"	26.6	35.6	9.0	5.6
27	"	14.6	33.5	18.9	3.5
28	"	20.6	24.0	3.4	00.0
29	"	23.6	33.0	9.4	3.0
30	"	21.1	34.5	13.4	4.5
31	"	23.6	34.5	10.9	4.5
32	"	20.6	35.0	14.4	5.0

Forwarded with annual report for the fiscal year ending June 30th 1900
W. H. Heuer
Lieut Col Corps of Engineers U.S.A.

MAP OF
SHAG ROCK NO. 1
IN
SAN FRANCISCO HARBOR, CAL.;
Showing 6 ft. contours
from low water to 30' in depth
SCALE 1" = 15'

NOTE:- Circles represent location of 10" diameter drill holes; The numbers to left of circles indicate order in which drilled; For details - see Table above.

after the blast showed hundreds of rocks in the air. One piece of rock, measured on an enlarged photograph, was estimated to weigh 7,000 pounds and was thrown to a height of some 500 feet.

Following the huge blast, the contractor brought a small dredge to the site, but soon found it inadequate for the task. On June 3, a new, large clamshell dredge began removing from 50 to 100 cubic yards of rock each day. Things didn't progress as quickly as hoped, however, in that the dredge could only operate 12 hours a day due to the strong currents. Further delays were caused by the current carrying away the moorings and because of the breaking of the dredge's bucket. Some of the rock was brought up and placed in a scow and then dropped in deep water by the boom of the dredge. Dredging and further surface blasting continued until the work was completed on July 30, 1900.

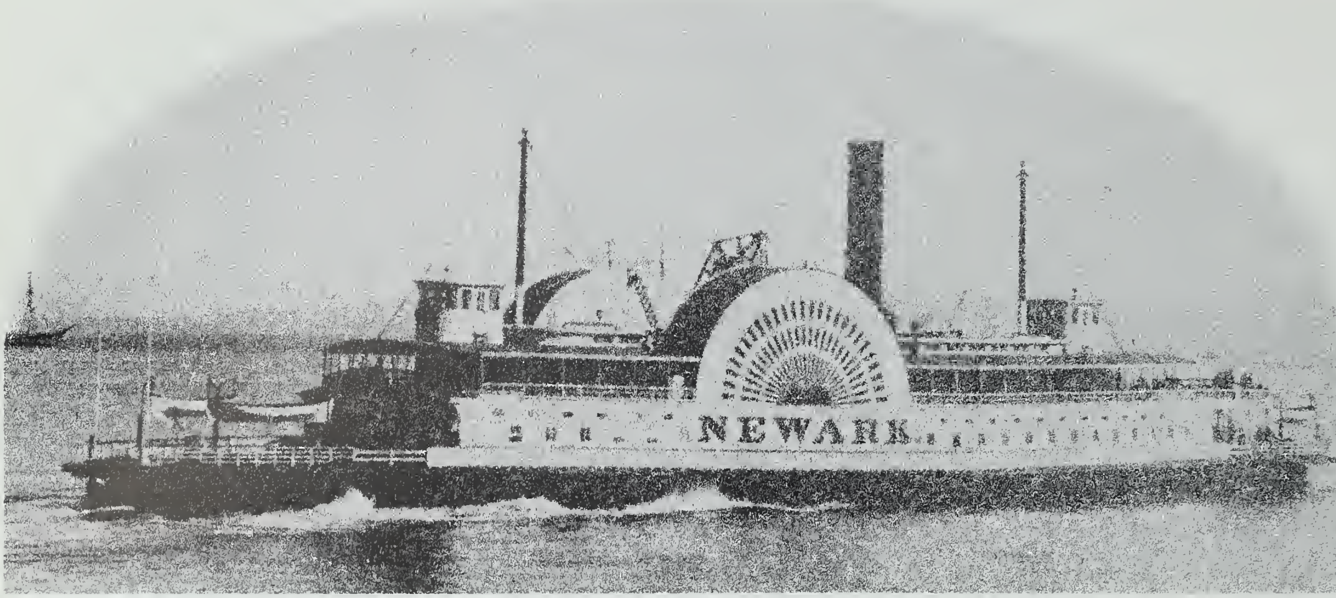
Shag Rock No. 2 was reduced by surface blasting alone. Bags of nitrogelatin were simply placed in haphazard fashion over the rock and exploded. The largest single charge fired at any one time consisted of 12,169 pounds of explosive on September 5, 1900. The blast raised a column of water over a thousand feet high and 240 feet in diameter. Many other charges were fired at various times afterwards, making the aggregate of explosive used 51,007 pounds. The work progressed slowly, but was finally finished on April 5, 1901.

The two Shag Rocks having been removed from harm's way, work was begun on Arch Rock. Drilling continued until August 14, 1901, by which time 326 holes aggregating some 3,247 feet in depth had been drilled. These were loaded with 41,535 pounds of nitrogelatin and on August 15, 1901, the final blast was fired, a pair of smaller charges having been set off previously. Dredging to remove the broken rock was undertaken on October 1 and completed during 1902. By 1903, removal of Blossom Rock to the 30-foot level was well underway. The work was completed at this site on December 28, 1903. By that time, a total of over $300,000 had been expended on the removal of the four rocks in the interest of safer navigation.

In addition to the natural obstacles found in the bay, man-made hazards, primarily in the nature of sunken ships, also proved dangerous to the extensive maritime trade on the bay and had to be removed. The San Francisco District's first significant operation of this type took place in 1875. The *Patrician* was lost in 1873 on the four-fathom bank about two and a half miles from Point Bonita. Preliminary examination of the wrecked vessel indicated that it did indeed constitute at least some hazard to navigation. Funds for removal were appropriated in 1875. Working under the supervision of Lieutenant Colonel C. E. Stewart, the diving firm of Longee Brothers investigated the remains of the *Patrician*. They confirmed Stewart's feeling that the strong currents of the area and tidal action had pretty well broken up the wooden vessel. A large spar, however, was visible during times of low tide and had to be removed. The spar obstruction was removed by firing a charge of gunpowder, and at an expenditure of $745.

By 1880, Congress authorized the Secretary of War to remove sunken vessels and to sell the salvage with the proceeds going into a

Opposite page:
Contour map of Shag Rock No. 1, by Lt. Col. W. H. Heuer, June 30, 1900.



In 1877 the South Pacific Coast Railroad's Newark *was the largest ferry on the bay. The* Newark's *42-foot paddle wheels were only surpassed in diameter by those of ocean steamers. Eventually the ferry was purchased by the Southern Pacific Company, was rebuilt as the* Sacramento *in 1923, and remained in service until 1955.*

fund for the removal of obstructions to navigation. The government could only exercise this authority when, given a reasonable amount of time, the owners hadn't recovered their property. The River and Harbor Act of 1882 enlarged the government prerogative to where wrecks would be sold even before they had been raised.

The British iron-screw steamer, *Escambia*, with a cargo of wheat, foundered on the bar at the entrance to San Francisco Harbor on June 19, 1882, and was perceived to be a serious threat to passing vessels. The owners were given notice of Corps intent, and bids for removal of the wreck were called for. On August 28, 1882, bids were opened, but all were rejected in that they were out of proportion to the government's estimate. Before new bids could be called for, another survey of the sunken ship determined that it had settled in the sand and mud to where it was no longer dangerous. Six months later, further investigation confirmed that there was still no risk to leaving it there, so no further action was recommended. Over the next few years, however, the shifting bay bottom raised the old vessel to where only 4 and a half fathoms covered her. Therefore a contract was signed with T. P. H. Whitelaw for removal of the boilers and other parts of the ship that might prove dangerous. In 1887 some 226 tons of metal was raised, the vast majority of which was sold at auction for just under $4,000, which was sent to the Treasury.

The first vessel to be lost in the 20th century was the 3,576-ton ship, *May Flint*. On September 8, 1900, she collided with the battleship, *U.S.S. Iowa*, and immediately sank in about 60 feet of water with her cargo of coal. The San Francisco District engineers examined the situation and determined the *May Flint* to be a menace to navigation and so notified the owners and the Secretary of War. Before long, the owners had removed most of the coal and then removed the vessel's superstructure to a depth 35 feet below low water. Total cost to the government amounted to $1.34, paid for two telegrams to inform authorities in Washington, D.C. of the matter.

By the turn of the century, San Francisco Bay was a comparatively safe, well-fortified harbor, the home of hundreds of ships, large and small, and the major port of call for more than a thousand vessels doing business on the Pacific Coast. For years, in fact, it was the only really safe harbor between San Diego and Puget Sound. From Napa and Petaluma in the north bay to Alviso in the south, the officers and men of the San Francisco District dredged channels, built jetties, reduced underwater obstacles, and laid out harbor lines to promote safe navigation and the overall economic and social well-being of the region. At the same time, they put up lighthouses to guide ships to safe anchorages and constructed fortifications to protect the entire works.

By the year 1900, the narrow strait connecting the harbor with the Pacific Ocean truly deserved the name Chrysopolae, or Golden Gate, which John Fremont christened it in 1846. Grain, gold and produce of every variety passed to and from the narrow channel, making the Bay Area the richest, most economically powerful area on the entire West Coast. And, just as Oakland and the other settlements around the bay prospered and gained a share of the maritime trade brought to and sent from the bay, so did the coastal towns and villages from Monterey to Crescent City benefit from the burgeoning commercial activity centered in and about San Francisco Bay.

Shipping on the Redwood Coast

The one factor that put California, and hence the San Francisco District area, several steps ahead on the path to an economic civilization, was the ready availability of her immediate resources — gold, soil, water and timber. Each helped support the other. In any expanding civilization, however, the first resource to be utilized is timber, for in order to build, one needs the raw material with which to build. California was uncommonly blessed with this resource. Besides the billions of board-feet that lay in the pine and fir forests of the Sierra Nevada, billions more crowded the slopes of the Coast Range, as redwood trees, from the Santa Lucia Mountains in the south to the Trinity Alps in the north — all of which lie within the San Francisco District. By 1860, there were more than 300 sawmills operating among the redwoods.

The primary market for timber after the beginning of the Gold Rush was, of course, San Francisco. This was true not only because the city was growing so quickly, but also because it kept burning down so often. Moreover, the problems of transporting lumber from the Sierra Nevada eliminated it as a practicable source of building materials for

the San Francisco Bay area, which looked instead to the redwoods of the Coast Range, particularly those on the coast north of San Francisco. Once it was realized that the timber supply south of the bay, from Monterey to Redwood City, couldn't possibly fill the requirements for growth, lumbermen turned to the north coast counties where the mountains provided the timber and the sea the transportation.

The Russians located at Fort Ross are credited with building the first sawmill in the redwood forests. Lumber produced there was used for building the fort, the cabins, and the church at Fort Ross, parts of which are still standing today.

Captain Stephen Smith, master of the *George Henry*, visited the Pacific Coast in 1840 and was tremendously impressed by the vast stands of timber. On the other hand, he was quite unimpressed by the lack of imagination demonstrated by the local settlers, which caused them to import lumber from the Sandwich Islands (Hawaiian Islands) when there was practically an unlimited supply virtually in their own backyard. On his next trip home to Baltimore, he rounded up some sawmill machinery and by 1843 he was back in California. Having located lumber at Monterey and at other places along the coast, he, with the aid of a dozen settlers, built a sawmill east of Bodega Bay on Salmon Creek.

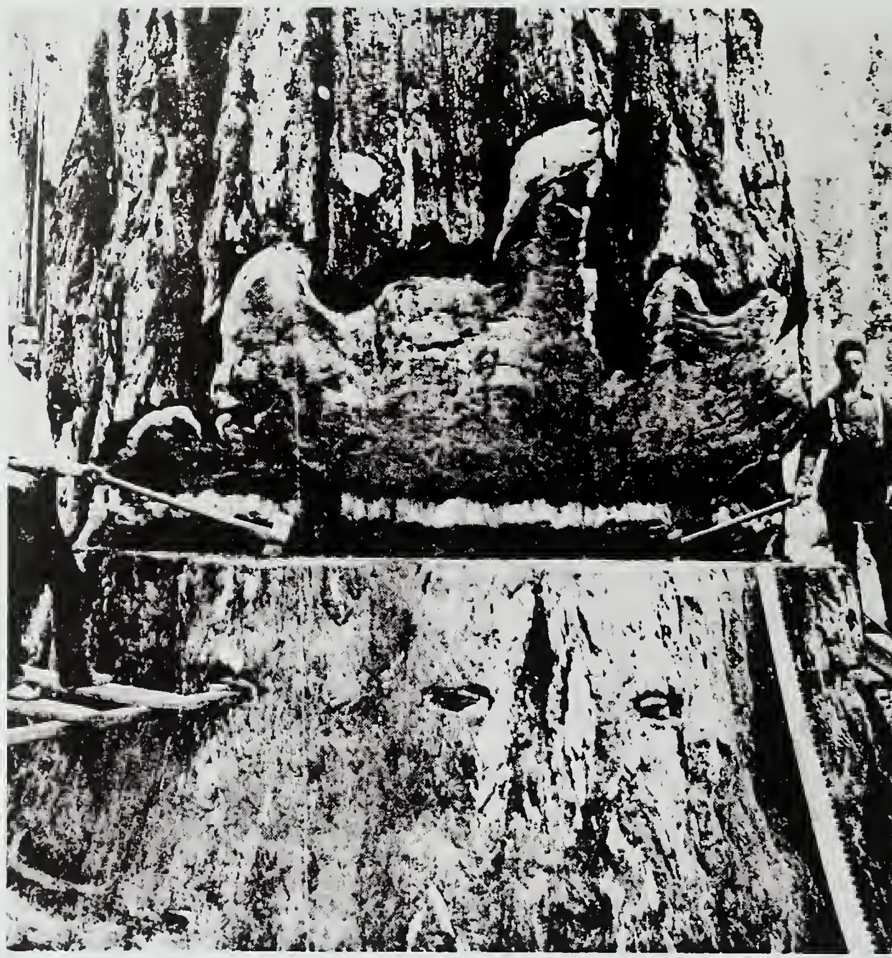
It will be remembered that the Englishman, William Richardson, settled at Yerba Buena Cove in 1822 and began operating sailing craft within the bay and along the coast. He married into a prominent California family, his wife the daughter of Commandante Martinez, and eventually became a man of comparative wealth. His holdings included a land grant of approximately 20,000 acres, thousands of head of cattle and several hundred horses. In the year 1853, Richardson built a sawmill on a river within his grant on the coast 117 miles north of San Francisco. He named the river Albion after his native country and, before long, the settlement of Albion became an important mill town.

Albion Mill – the Albion River, 1860

It will also be recalled that miners, while working their way down the coast, discovered and spread the word about the merits of Humboldt Bay during this same period. Soon the villages of Union (Arcata) and Eureka were thriving along its shore. It didn't take the frontier settlers long to learn of the values of redwood. Its resistance to fire made it popular for homes and businesses and its resistance to decay made it useful for railroad ties, which were needed in quantity during the 1860 s and 70 s. In addition to the mills already mentioned, another was established by the San Francisco promoter, Harry Meiggs. In 1852, he loaded a complete sawmill aboard the *Ontario* and shipped it to Big River, the name by which Mendocino City went in those early days.

Logs were stored on Pudding Creek north of Fort Bragg until they could be moved to the mills for processing.

A giant redwood log splashes into Little River on its way to a mill.



Felling a 14-foot redwood in the 1800s with double-bitted axes and crosscut saws sometimes took several days. The men stood on springboards several feet above the ground to better work on the tree.

The great trees were felled, cut to workable length, linked together with chains and then snaked out of the forests by long teams of oxen or steam donkey-engines. The huge logs were then dumped into the rivers and floated down to the mills established at the tidewater. From the mills, the finished lumber was carried by tramways to loading points on the cliffs above the sea. Here the planks, beams, railroad ties and boards were loaded on the lumber schooners by way of chutes suspended out over the water. The sliding cargo was controlled at the ship end by means of a hinged device called an apron that could be raised and thus stop the material when it was just above the deck. Later methods employed a wire cable stretched from the cliffs out into the ocean or cove and anchored. The ship lay underneath the lower end of the cable, which let down the slings of material by gravity to a point just above the deck of the schooners built especially for this trade. This wire chute method of loading prevailed at such places as Greenwood, Albion, Little River, Big River, Caspar, Noyo, Hardy Creek, and at least a dozen other "dog holes" along the coast. A dog hole was a "port" just big enough for a dog to crawl into, turn around and crawl out of. Such inadequate harbors, together with the notorious and unpredictable weather conditions, made the coastal lumber trade one of, if not the most dangerous, occupations in the west.

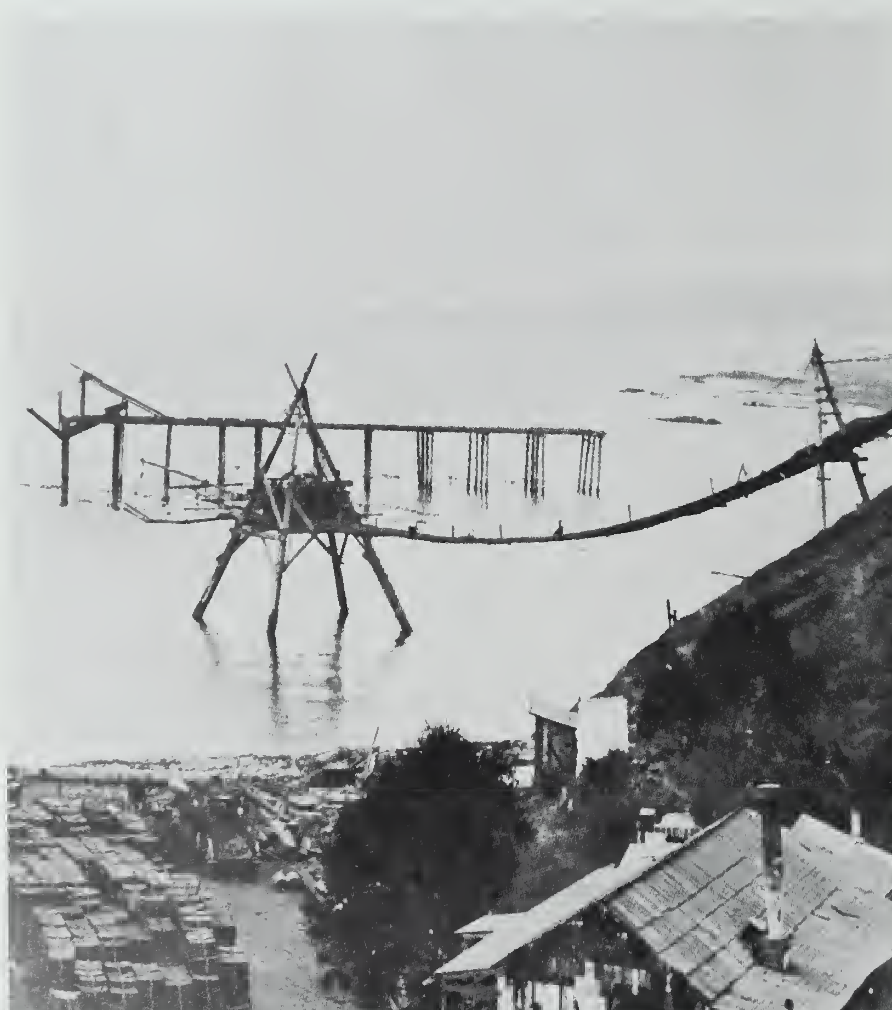
A lumber schooner makes a stop at Signal Port, also known as Hardscratch, some ten miles south of Point Arena. Lumber slid down a 200-foot greased chute to the ship.

On the night of November 10, 1865, alone, ten schooners and their crews were driven onto the rocks. Even so, more than 300 lumber schooners (a west coast invention) at one time or another carried the materials of progress from the steaming mills of the coast to the spreading metropolis on San Francisco Bay. With feet braced on the pitching decks of the modest vessels, men handled the heavy planks that shot from the ends of the chutes with amazing speed. Supposedly the job required quick hands, strength, and nearly total disregard for one's survival.

Considerable coastwise traffic preceded the development of the redwood trade. Farmers, merchants and lumbermen from Monterey to the Oregon border were, of course, anxious to cash in on the colossal prices charged for foodstuffs and building materials at San Francisco and in the mining regions. Equally important to them were the finished goods, machinery and commodities which could only be secured from the industries and wholesalers located in San Francisco. By the 1880s this trade, stimulated by the tremendous shipments of redwood lumber, was at its height, with over 100 loading points scattered from Crescent City to Monterey Bay. To gain what they perceived as their fair share of the business, the people of these villages and mill towns appealed to the San Francisco District Engineers for safer and better harbors.

The initial projects, undertaken for the safety of coastwise shipping, were the lighthouses, under the Corps' supervision until 1910, when President Taft saw fit to abolish the lighthouse board and replace it with a Bureau of Lighthouses within the Department of Commerce. Hard on the heels of the lighthouse construction effort came the multitude of examinations and surveys of practically every harbor, port, loading point and dog-hole from Cape San Martin to Point Saint George. The first of these was undertaken at Crescent City Harbor by Lieutenant Robert S. Williamson in 1867, about the same time the first improvement in San Francisco Bay was made with the reduction of Blossom Rock. Williamson, in company with Lieutenant William Heuer, made a cursory examination of Crescent City Harbor, primarily from data on hand and by personal inspection. In his report dated July 29, 1867, he recommended that no appropriation for improving the harbor be made, since the cost would (in his opinion) run to over $2 million and the level of commerce at that time couldn't justify that kind of expenditure.

In 1871, he made a survey of Monterey Harbor in conjunction with a commission appointed by the California State Legislature. The State officials wanted to know if Santa Cruz and Salinas harbor areas



Bales of shingles are stacked at Point Arena next to a wire chute used in loading ships.

could be made suitable for a harbor of refuge and if, in fact, either or both could be improved at all. Williamson shared his findings with the State commission, wherein he estimated a breakwater would cost between $5 and $6 million. He made no specific recommendation as to when, or if, the project should be initiated.

At about the same time, he answered an urgent plea for help from local residents around Humboldt Bay. After studying the situation at length, Williamson stated in his report of July, 1871, that he considered it impossible to make any permanent improvement of the bar at the entrance to Humboldt Bay or Eureka Harbor. On August 8, 1871, the matter was referred to a special Board of Engineers who, after considering the situation for a month, agreed with Williamson: permanent improvement of the entrance to the harbor was simply impracticable. They did suggest that additional aids to navigation be placed to facilitate access to and egress from the harbor.

Only a year later, the San Francisco District was directed to take another look at Santa Cruz Harbor and to also make an examination and survey for a breakwater, or seawall, at Trinidad Harbor. Lieutenant Colonel C. S. Stewart, as a member of the Board of Engineers for the Pacific Coast, surveyed the Trinidad area and in his report of September 25, 1872, estimated that a breakwater for the least length then being proposed would cost in excess of $13 million and, for a better length, some $19 million would be needed. More than that, he figured it would take from 25 to 50 years to complete the work, given the construction methods of the time. Needless to say, his report regarding recommendation for improvement was unfavorable.

Stewart also made the follow-up survey at Santa Cruz. His unfavorable report, dated July 26, 1873, contained an estimate of over $10 million for a breakwater of 2,300 yards in length and one in excess

Shortly after the turn of the century the steamer Pomona *foundered on the rocks off Fort Ross.*

A steam winch is used to load lumber on a schooner headed for San Francisco.

of $11 million if auxiliary construction off Point Santa Cruz was made. He figured such a project would require 75 to 100 years for completion in view of the prevailing construction and funding conditions. The shipping interests around Monterey pressed on and secured yet another survey two years later. But once again, the engineers couldn't justify spending $11 million to improve the harbor.

This pattern, with the one exception of Humboldt Bay, would remain the template for the District's action on the coast for the next 25 years. Responding to Congressional directives and to their own concern for the safety of crews and vessels plying the Pacific Coast waters, the engineers at San Francisco examined, surveyed and re-surveyed literally every shipping facility in the district during the last quarter of the 19th century.

Their search for a harbor of refuge began in earnest in compliance with a House of Representatives Resolution dated April 27, 1876, whereby the engineers were authorized to examine the harbors of Mendocino, Humboldt Bay, Trinidad, Crescent City, Drake's Bay, Bodega Bay, Mack's Arch and ports along the Oregon Coast.

Later they carried out preliminary examinations in the open and exposed ports on the North Coast, trying to determine the feasibility of improving these small, rugged ports of call in the interest of safer navigation. Included in the list of facilities examined were: Fort Ross, Frisk's Mill, Fish Rock, Shelter Cove, Timber Cove, Stillwater Cove, Gerstles Cove, Stewart's Point, Bihler's Point, Robinson's, Bowen's Landing, Collin's Landing, Nip and Tuck, Hardscratch, Rough and Ready, Sounder's Chute, Buster's Landing, Point Arena Landing, Bridgeport, Uncle Abe's, Cuffey's Cove, Navarro, Salmon Creek, Albion, Big Gulch, Little River, Mendocino City, Northport and the mouths of the Klamath and Eel Rivers.

According to the engineers' report, all of the above had private moorings, used entirely for commercial purposes. Nearly all afforded

The Bobolink, *bound for San Francisco, became stuck in the rocks at Kent's Point, near Mendocino. 185,000 board feet of lumber was salvaged from the schooner before she broke up on the rocks. The ship's cook was lost overboard.*

Typical of the North Coast "dogholes" was Greenwood, where brave little ships loaded lumber from wire chutes.

some shelter against northwest winds but it was believed that none offered any protection against the southerly or southwesterly winds of winter. While each was unique in one way or the other, all of these tiny harbors had many features in common. A description and summary of the situation at Shelter Cove will serve to illustrate the general feeling of the District with regard to improvement of the areas at that time.

Shelter Cove is situated about halfway between Fort Bragg and Humboldt Bay. The bottom is rocky, with some sand and broken shells. The shores on the east side are very steep and, within a half mile, rise to a height of about 1,400 feet. The little harbor contained a wharf 840 feet long and 40 feet wide at its outer end; three moorings consisting of anchors weighing 2,300 pounds, 1,260 pounds, and 1,200 pounds respectively, with chains 20 to 30 fathoms in length and about 1 and one-half inches in diameter; and a single rock mooring with a 700 pound anchor and some 30 fathoms of 1 and one-half inch chain.

At Rockport, north of Westport, the Rockport Redwood Company constructed a 250-foot iron bridge to a small rocky island so that a ship could load. The bridge lasted but 24 months.

Late in the 1880s specially built steam schooners replaced sail-powered vessels in the lumber trade. On the far left the Scotia *and* Prentiss *wait in the "harbor" at Westport for a shipment. The rather unique wharf was built 400 feet out over the rocks to bring the lumber and the ships together.*

A dozen huge logs are pulled on their way to a mill in the Mendocino redwoods.

Men and oxen move giant logs in this typical lumbering scene recorded in 1857 on the North Coast.

This was a place where vessels occasionally sought shelter against severe northerly or northwest storms, either using their own anchors or tying to the existing moorings. During the late 1880s, one little steamer, the *Mary D. Hume*, made regular trips to the cove in the summer season about once each week. Occasionally a schooner would also come in for a cargo. As the harbor afforded no protection against the prevailing winter winds, vessels would not go to Shelter Cove during that time of the year. From May to November, 1888, the *Mary D. Hume* loaded 1,322 head of sheep, 122 tons of wool, 181 cords of bark, 70 tons and 446 sacks of ground tan-bark plus a few hides at Shelter Cove. This was typical of the products other than redwood shipped from other places and loaded from this and similar facilities along the North Coast.

The District's engineers, after examining each of these ports, reported that, while government assistance might relieve the owners of the expense of annual maintenance, it would not in all probability affect the commercial prosperity of the port or vicinity, nor would it reduce the transportation or insurance rate of vessels, nor add materially to their safety when seeking shelter. Under these circumstances, the engineers thought it inappropriate to spend public monies for improvements.

The exception to the negative reports filed during the last quarter-century of the 1800s relative to coastal harbor development was the one for Humboldt Bay. The harbor is on a landlocked bay at

Eureka about 225 miles north of San Francisco and 87 miles south of the California-Oregon state line. Presently, the area tributary to Humboldt Bay contains 80 per cent of the world's supply of redwood timber, as well as large stands of Douglas fir. Moreover, it is the site of California's largest center for oyster cultivation and the major port for lumber products, including pulp.

Early records tell us that the Josiah Gregg party came upon the bay in 1849, while looking for the mouth of the Trinity River. Gregg died on the rugged trek to San Francisco, but the emaciated survivors of his group spread the word about the exceptional qualities of the place. Eleven ships and several overland expeditions were hastily outfitted by competing men who believed the bay had a future as a port for the Northern Mines. Of the eleven vessels which left San Francisco in the spring of 1850 to pioneer a port to supply the mines of the region, the first to sight Humboldt Bay was the schooner, *Laura Virginia*. When Hans Henry Buhne, first mate, entered the harbor in a small boat, the great race was undertaken in earnest. There would be years of fierce competition between rival ports on the bay before the winner, Eureka, was finally recognized.

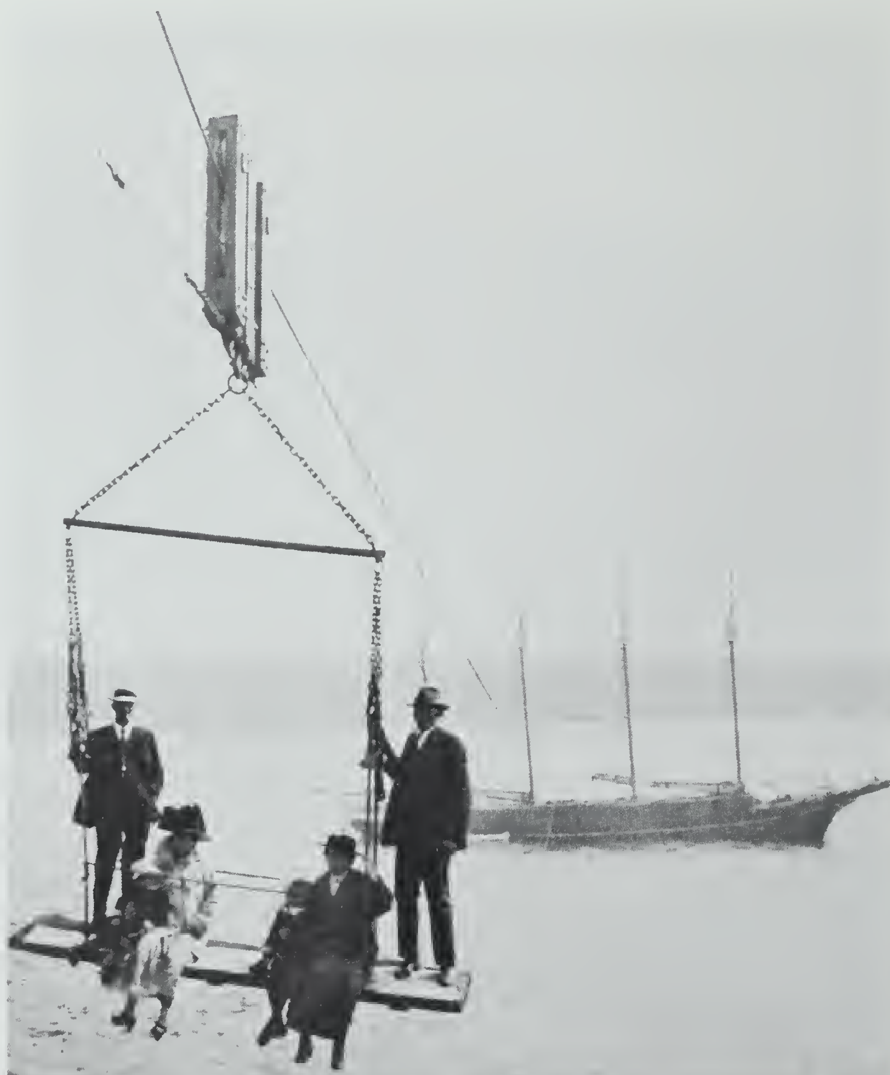
The first settlement was Humboldt City, founded by the captain of the *Laura Virginia*, Douglas Ottinger, on April 14, 1850. The town faded quickly however, because it was located too far south to successfully compete in the trade with the Klamath mines. First mate, Hans Buhne, eventually settled on Buhne Point after trying his hand as a miner, merchant, harbor pilot, whaling master and hunter. Later, he made a fortune as part owner of one of the biggest sawmills on the bay.

North of the Elk River, named by the Gregg party after it enjoyed a dinner of elk meat near the stream at the southern end of the present-day Eureka, David Buck founded Bucksport during the summer of 1850. It will be recalled that Fort Humboldt was situated on the bluff overlooking this spot.

James T. Ryan of the Mendocino Company is the man frequently credited for the founding of Eureka in May, 1850. Some accounts have Ryan jumping ashore from a small boat, yelling "Eureka — I have found it." Whatever the case, Ryan went on to become a well-to-do lumberman, general of the local militia and a state senator. For a time, Eureka's development didn't keep pace with its neighbor, Arcata (Uniontown), established just a month earlier. But being positioned as it was at the head of deep water navigation on the bay, Eureka held the decisive advantage when lumber exports outstripped trade with the mines. Just four months after Ryan founded the town, two businessmen, Jim Eddy and Martin White, set up the first mill there. Then, in 1852, Ryan in partnership with James Duff ordered machinery from San Francisco for another mill. When their equipment was swept off the deck of the *Santa Clara*, Ryan had the vessel beached, removed the ship's engines and used them to power the new lumber mill. As luck would have it, the first shipments of lumber from the Duff-Ryan Mill were lost when the brig *Clifford* and the bark *Cornwallis* foundered on the Humboldt Bar. Over the years, this was the all-too-familiar pattern for ships and crews leaving Humboldt Bay.

Yet another pioneer on the bay, William Carson, left the gold fields for lumber in 1856. He leased a mill in Eureka that year, began felling, sawing and shipping redwood. He came upon hard times after a bit, but then teamed up with William Dolbeer, inventor of the donkey engine. Dolbeer's marvelous machine revolutionized logging on the North Coast. Carson's three-story redwood mansion, built in 1884, gives at least some indication of the wealth and influence he and his associates enjoyed as by-products of the lumber trade.

As mining gave way to lumber, Eureka and its sister communities continued to grow on a solid foundation of redwood. This in turn was soon bolstered by substantial ventures in shipbuilding and fishing. At Fairhaven alone, where Hans Bendixsen opened a shipyard in 1865, more than a hundred vessels were launched, including barks, barkentines and steam schooners. And fishing eventually would produce more tonnage at Humboldt Bay than that brought into San Francisco. By 1971 the industry had grown to where Eureka fishermen caught 30.5 million pounds for the year in contrast to less than half that amount landed by San Francisco boats!



Captain Schuyler Colfax Mitchell and his family ride up the loading cable on a sling from the large schooner Irene *to Noyo Wharf. The* Irene *was taking on 900,000 feet of redwood for Australia.*

Besides the position Humboldt Bay held, and continues to hold, as the chief harbor between San Francisco and Portland, it was, and remains, the only really safe harbor of refuge for more than 250 miles south and almost 200 miles north of its location. So this aspect too, besides its potential for commercial development, led the San Francisco District's engineers to look with favor to its improvement in 1881. After studying the bay for a decade, funds for its improvement were made available to the Corps of Engineers in the River and Harbor Act of March 3, 1881, following a survey requested by and incorporated in the Act of the previous year. By that time, some 600 vessels were entering and leaving the port annually, carrying more than half a million dollars worth of farm products from its docks in addition to the tens of millions of board feet of lumber shipped out.

One of the most difficult aspects of planning the improvements for Humboldt Bay was how to deal with its ever changing sandbar which blocked the entrance. Early in 1851 the bar bore west and was about one-half mile from the north spit, with a depth of 3 and one-half fathoms. In the fall of 1852, the bar was reported to have moved

Dolbeer's donkey engine revolutionized the logging industry. Using manila rope and a side-spool, men used the device to snake logs out of the woods.

Lumber processing and shipping were only part of Humboldt Bay's economic foundation. Shipbuilding soon added a major part to the overall sustained growth of the area. During the late 1800s the 970-ton four-masted barkentine Jane L. Stanford *was launched at Fairhaven, south of Eureka. Upon completion in 1892 she was the largest sailing vessel built in California to that time.*

northward its entire width. During the winter of 1853-54 the bar again changed its position and the depth over it was but 16 feet at high tide. In 1857, less than 13 feet at high tide could be found upon it and its extent had dramatically increased. Wave and tidal action cut through the barrier until, in 1869, the bar had sufficient water for the largest lumber-laden vessels, but had moved to the northward a mile and a half from where it had been only months before.

When comparing the sandspits which formed the heads of the harbor entrance from one survey to another, the engineers noticed that they, too, shifted position. Of particular interest seemed to be the distance between the spits and the overall condition (depth of water over) of the bar. It seemed to them that when the spits were closest together, there was the coincidence of adequate water over the bar. In 1881, however, they weren't prepared to generalize to the point wherein a narrow entrance always makes a good bar. In their opinion the bar was made and its position determined by the sea, first by storm waves and secondly by current influence. Using the limited information available to them, they decided to do what was possible to concentrate the tidal and current action through the bay and over the bar to produce the best results.

The total area of the bay in 1881 covered about 24 square miles, the northern part containing 18 and the southern part about six square miles, the two parts being separated by the entrance from the sea. At the time, most of the bay was absent of water at low tide. Just inside the harbor entrance to the bay there was a natural channel leading north which, before it reached Eureka, subdivided into three,

separated by mud flats and low islands. There was also a channel from the bay entrance which led south for several miles. Eureka was located on the northwest side of the bay, about four miles from the entrance, on the smallest of the three channels into which the main one separated. This channel was some 450 feet wide, and only eight or nine feet deep at low-water. Of the initial $40,000 appropriated for the work in 1881, the engineers proposed to spend about three-fourths of it in dredging a channel in front of Eureka.

Schooner Electra *on the ways of Thomas Peterson's Shipyard at Little River. More than a dozen vessels were built here during the boom days of the 1860s and 1870s.*

Eureka 1880 – The fancy building on the left is the Vance Hotel. "G" Street runs alongside the hotel and down to the bay.

Under a contract with Warren B. English, signed June 30, work on the harbor improvement began on September 1, 1881. English used a clamshell dredge, built at Eureka, and a pair of dump scows, into which the dredged material was placed and then towed by a tugboat to the spoils area. Between the first of September, 1881, and May 31, 1882, the contractor removed over 80,000 yards of mud, sand and shells from the channel fronting the Eureka wharves to provide a 10-foot depth about 240 feet wide and 4,100 feet long. Under a subsequent agreement, English was directed to dredge another channel so as to provide eight feet of water near Arcata, whereby he removed in excess of 14,000 cubic yards of bay bottom. Arcata, at the time, had three mills in operation, railroad connections, and was itself the shipping point for much of Humboldt County and mines on the Klamath and Trinity Rivers.

The work being done at Humboldt Bay was under the overall supervision of Corps District Engineer George H. Mendell from his office in San Francisco. His man on the scene was assistant engineer, A. Boschke. Besides overseeing the dredging operation, Boschke was busy making the first detailed study of Humboldt Bar. In accordance with Mendell's instructions of August 9, 1881, the assistant engineer proceeded to Eureka and set up shop. He began his hydrographic survey of the entrance and bar almost at once to ascertain as quickly as possible the configuration of the channels and shoals. Boschke reported that when it wasn't absolutely necessary for him to be personally supervising the dredging, he was dedicating his time to the familiarization of the problems associated with the harbor entrance. Current and tide observations were made, and monitoring of the spits continued. Remembering the relationship mentioned by others relative to bar condition and positions of the spits (jetties — headlands), he perceived it desirable to maintain the spits or headlands as they were in September, 1881. To do this, he tried to construct brush jetties, made from willows held between large planks. At first, it looked as though his experiment might work, and hold the shifting sand in place. But the strong counter-current and the huge breakers of the winter storms undermined his makeshift jetties and Boschke had to abandon the scheme for the time being.

A bit discouraged, but not defeated, the engineer began studying and comparing maps, charts and reports from every quarter to learn all he could about the forces at work shaping and reshaping the harbor entrance. He camped on the sand and observed, he interviewed long-time residents, spoke with ship captains and tramped over the area for months. In the end he developed a well-reasoned theory involving tidal action, currents, storm waves, counter currents, and other physical factors that he felt needed to be considered if any permanent improvement was to be made. Colonel Mendell reviewed Boschke's work and subsequent ideas and came to the same conclusion.

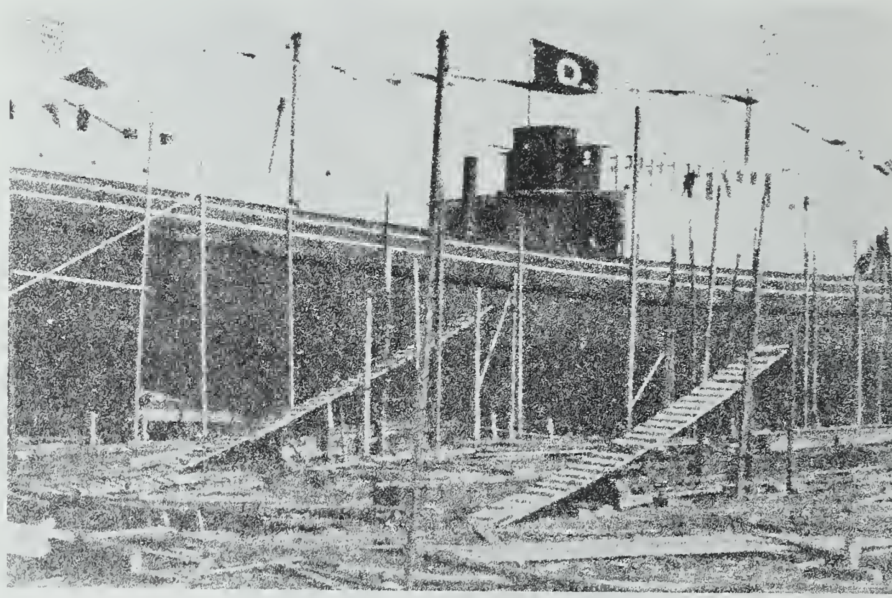
The work on improving the harbor entrance could not begin at once for several reasons, the most important of which was the Engineers had to wait for nature to reshape the south spit to the

Bret Harte drifted into the Humboldt Bay area in 1857. Having failed to make a living in San Francisco, he went to Union Town (Arcata) to stay with his sister Maggie, wife of a purser who worked on a coasting schooner. His literary talent had yet to bloom.

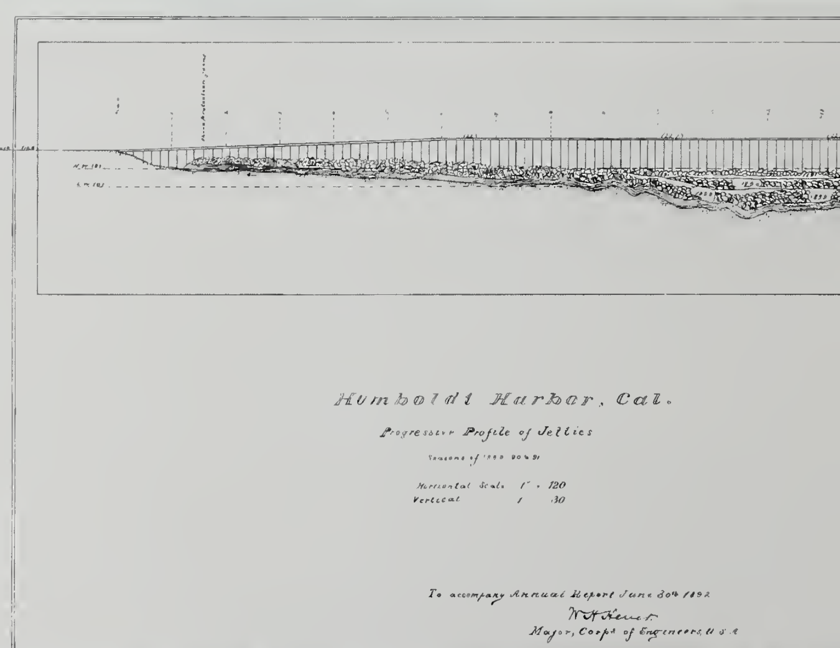
desired configuration. According to their thinking and based on the action of the bar and the spits since 1851, the changes of width and those of depth were part of the same general phenomenon. Both changes appeared to result from variations in the elevation of the south breaker, lying to the seaward, which at times stood at about the level of low-water and at other times several feet below low-water. Their theory held that in the former state of elevation it appeared to play a double role. It was a training-wall, effectively guiding the tide in one main channel of moderate width to the shoal bar and was, at the same time a bulwark or breakwater protecting to great extent the north point from the attacks of the sea. On the other hand, when the elevation of the south sands fell below the level of the tide, a larger portion of the ebb escaped over it and its function as a training-wall was impaired, to the injury of the bar-channel. The increased depth on the south sands favored the transmission of the westerly sea and thus increased the exposure of the north spit.

Where a beginning was made in lowering the elevation of the south sands, the tendency of the tidal flow became more and more

determined to take that direction because of the erosion which gradually developed. At the same time, the increased width of the entrance favored a dispersion of the tidal action. The tidal flow being no longer concentrated, the effective depth was diminished and for a time the navigation of the entrance was considerably impaired. The end result was that vessels loaded with lumber, produce and passengers which had been accustomed to enter and leave freely were held up until a coincidence of a spring tide and a smooth sea permitted them to cross the bar. Mendell reported that during the period when the San Francisco District began its improvements, delays were often quite prolonged.



The Mary Olson *under construction at Humboldt Bay.*

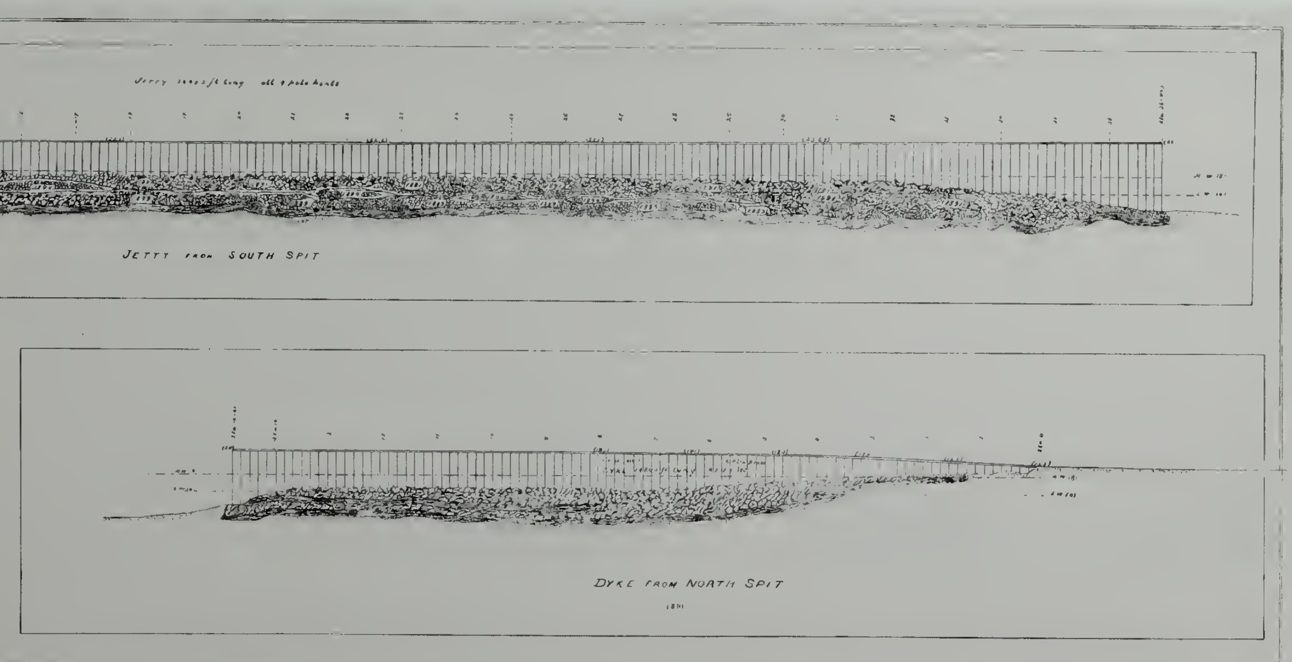


Progressive profile of Humboldt Harbor Jetties, 1892.

Eventually, after a period of some time during which there was shoal water on the bar, the tidal flow again became concentrated in one direction and the sands bounding the new channel increased in height and resumed their functions as training-walls, with the result being good channel over the bar. As of January, 1883, the condition of the channel was not favorable for beginning improvements to the entrance of the harbor. The Engineers would have to wait for nature to redirect the channel toward the north and to raise the south sands to or above the level of low water.

Mendell recommended that once conditions were right the south sand spit should be captured by placing a low revetment of rubblestone over it. The object was to hold these sands in place at or a little above low water. If that operation should prove successful, he was prepared to recommend raising the jetty to mid-tide level or higher. The line the jetty would occupy was to start near the end of the south spit and extend in a northwesterly direction for a mile and, depending upon additional findings, bend a bit to the west for about a thousand feet. The reason for the imprecise estimate regarding the work was obvious. A project of this type had never been attempted before on the Pacific Coast and, more than that, the work was based on an unproven theory. Mendell, in his report of 1883 to the Chief of Engineers, also pointed out the natural hesitation of many to propose works to be built on sand when they would be exposed to the heavy seas of the Pacific Ocean.

While the District's engineers were waiting for nature to set things straight, they continued to carry out improvements within the bay itself. By 1884, a channel 13 feet deep and 200 feet wide had been dredged to the head of the Eureka wharves and another 10 feet deep and 100 feet wide to Arcata and Hookton.



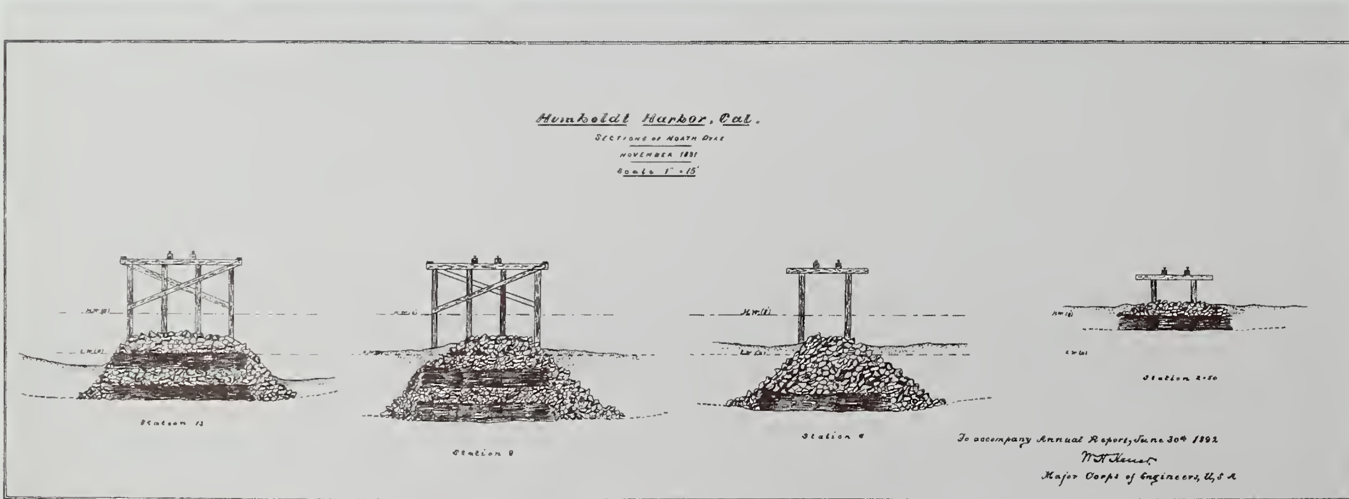
Appropriations for improving the harbor entrance were made in 1884, 1886, and 1888, aggregating $262,000, but because the individual appropriations were modest, they could not be used until sufficient land required for the project was secured, free of expense to the Government. Mendell spoke out strongly and repeatedly against the practice of providing relatively small annual amounts of funds for the type of work envisioned. He even stated flatly that it was better not to attempt a project of this magnitude at all than to attempt it inadequately! For him, there was no safe middle ground of compromise relative to the funding required.

Work on the south spit jetty was finally begun, under contract to the American Bridge and Building Company, in May, 1889. In his report to the Chief of Engineers, Major William H. Heuer stated that the company was supposed to do some $250,000 worth of work consisting of laying railroad track and pier work, as well as rock and brush work. By the end of June, 1889, the contractor had completed 1,605 feet of shore protection wall composed of brush and stone. Some 6,000 tons of rock and over 3,000 cubic yards of brush were used in the construction. Work on extending the trestle in the water, from which the jetty was to be built, was carried on until December 6, 1889, when winter weather shut down the operation.

By June, 1890, the new jetty reached out from shore for more than 3,000 feet. It was made up of brush mats placed over the sand and held in place by stone. About six tons of rock per running foot were required to sink and hold the mats at a cost of $5.50 a foot.

During the summer of 1890, the work was under the direct supervision of assistant engineer, W. P. Smith, and inspectors Frank Burt and W. D. Woodbury. They reported to Major Heuer in San Francisco that even though violent winter storms had lashed the partially completed jetty, for the most part, it held up well. Of concern, however, was the wooden pier (trestle) by which the jetty beneath it was constructed. It was subject to not only violent wave action, but destruction by teredos (shipworms) as well. With the heavy seas

Sections of North Dyke, Humboldt Harbor, 1891.



rolling against it, and the marine borers eating away at it, the supervisors believed it probably wouldn't last more than a year. Thus, they were in a hurry to get the project completed.

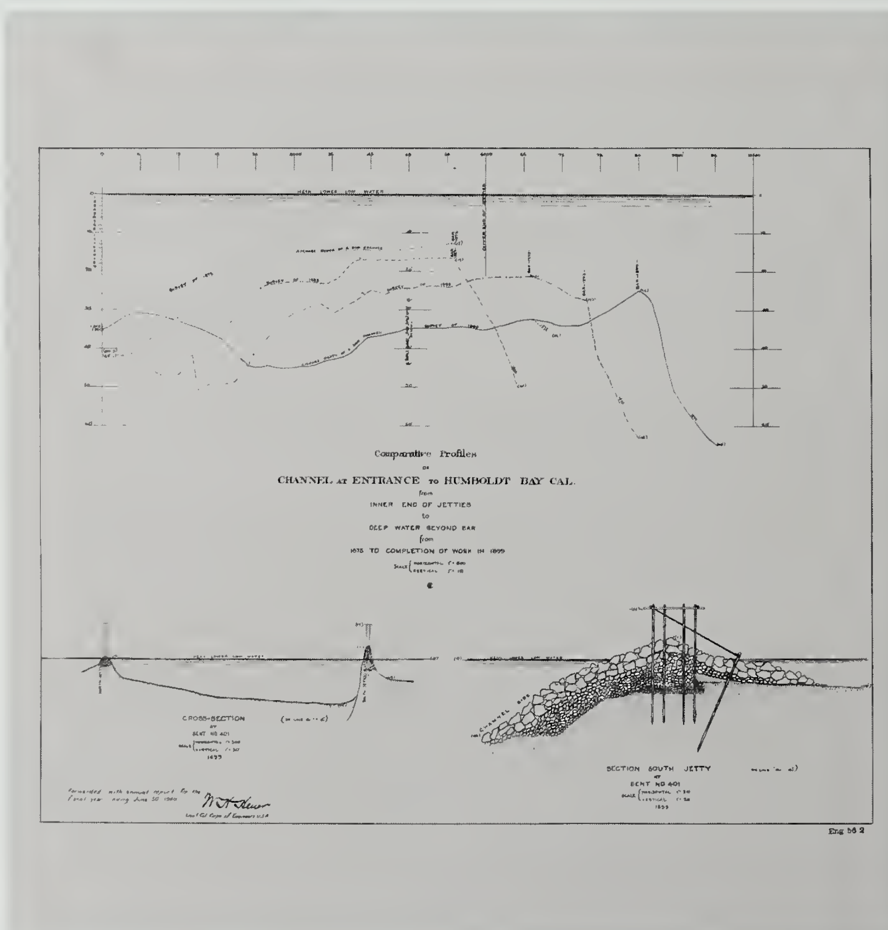
The new work didn't, and really wasn't expected to have an immediate effect upon the bar depth. A great many changes took place in the north spit as a consequence of constructing the south jetty. Some 2,000 feet of it washed away. Heuer reported that he felt it was time for a board of engineers to convene, and decide upon two issues: should a second (north) jetty be built, and should either or both be raised to a higher level than was at first thought necessary.

The next year, 1891, a board was in fact brought together and did recommend that a new jetty be put up about 2,100 feet from, and roughly parallel to, the first and both raised to high tide level. Even though accepted and then modified slightly, once underway, the recommendations were implemented immediately. Also of importance was the authorization of the work to be placed under the

continuous contract system in 1892, insuring the sequential development of the improvement. By the summer of 1896, $81,000 had been spent for dredging within the harbor and over $700,000 to improve the harbor's entrance. At the time, the south jetty was 3,700 feet in length and the north jetty over 6,000 feet. Moreover, the trestle had been completed and mattresses sunk for a distance of 7,500 feet and the channel across the bar deepened to 25 feet for a width of 100 feet. The trestle and foundation of the south jetty was also extended to a length of 4,800 feet.

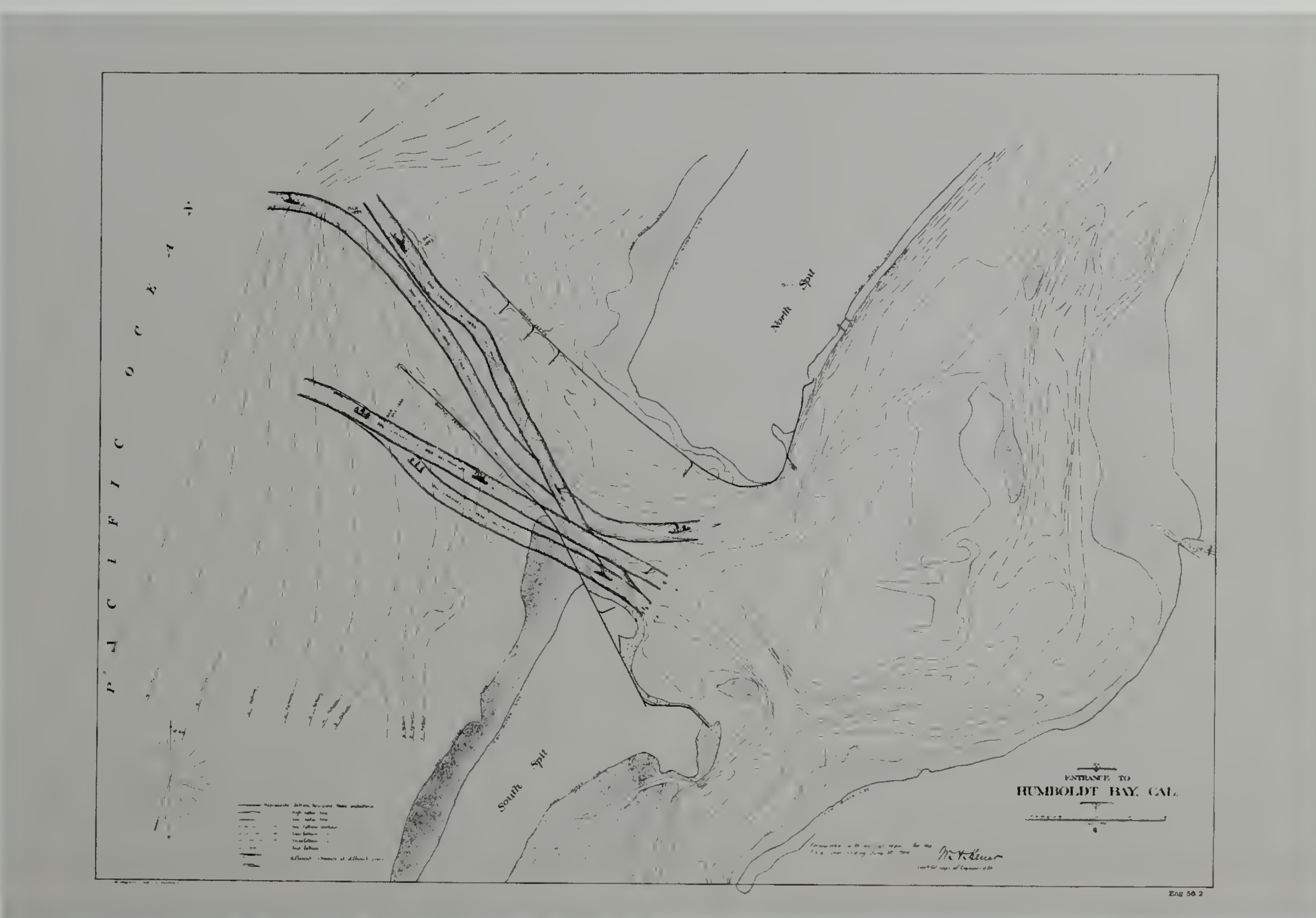
By 1900, the project was completed as originally planned. Two jetties extending seaward about 8,000 feet had been built, with a crest height of from 5 to 10 feet above mean low-water for most of their lengths and somewhat lower as each pushed into the heavy seas. The total quantity of rock placed in the jetties to that time was over a million tons, covering 88,000 cubic yards of brush, in the form of willow mats placed as a foundation on the unstable sands. It is interesting to observe that the estimate of the Board of Engineers, made in March, 1891, was $2,057,615. The actual cost of the work to 1900 amounted to $2,040,203, of which the engineering expenses were but $59,000, or less than three per cent of the total.

The contributions of the San Francisco District's engineers were varied and substantial even before the turn of the century. They



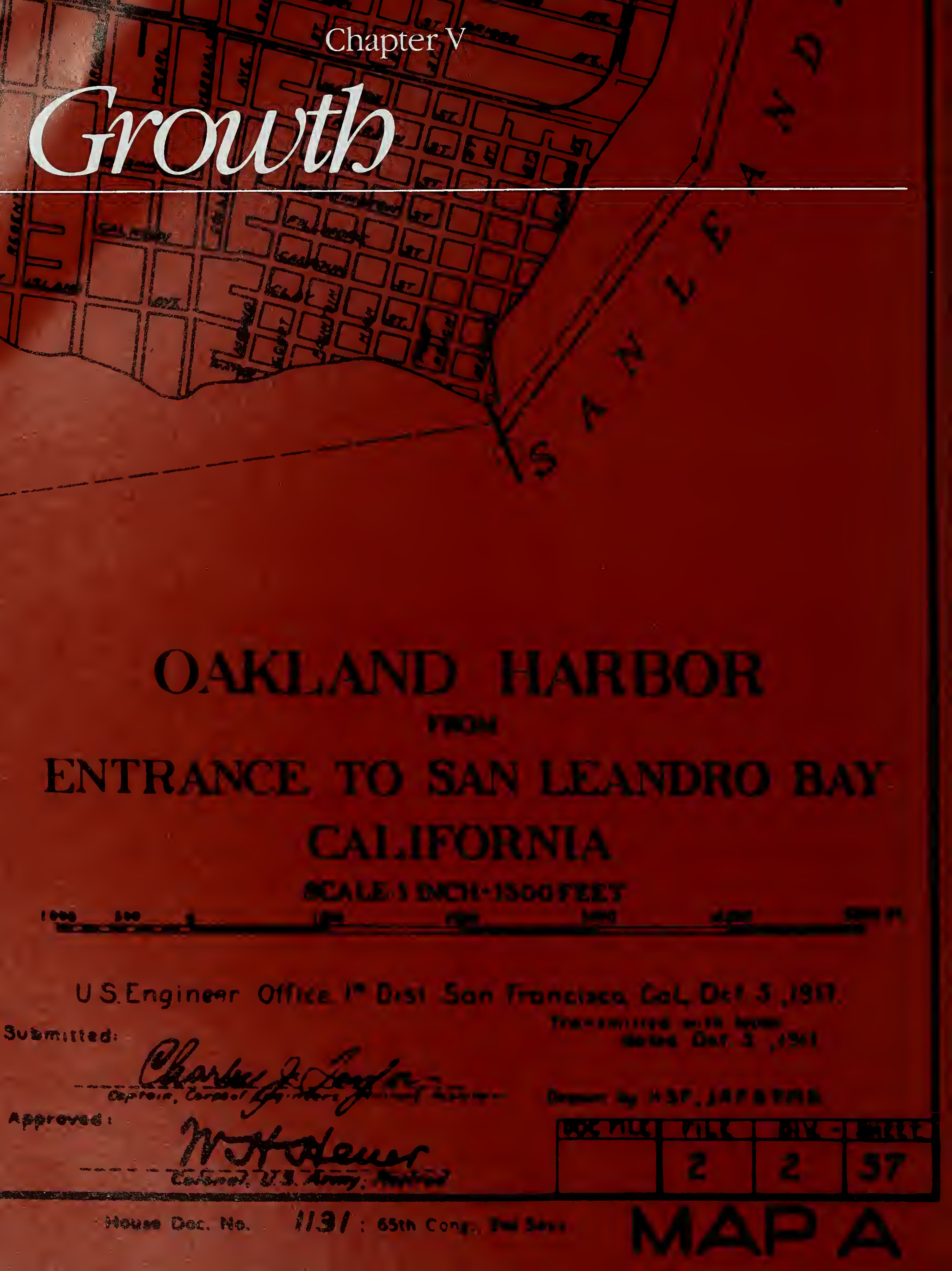
secured the entire region by fortifying the harbor that provided entrance to the interior, making it impenetrable to any foe. But more than that, the engineers protected the settlers and developers of the Pacific Coast by mapping the area, building roads and lighthouses and improving the natural harbors — all of which lent sustenance to and championed the economic and social growth of the Far West.

This was, figuratively and literally, the period of foundation building. The last 50 years of the 19th century witnessed men and machines transforming a raw wilderness into a peerless commonwealth of material and cultural prosperity. Terrific potential, hostile environment and boundless resources were recognized, tamed and shaped by men and women of uncommon vision and superior force of will. While all of these exceptional people weren't a part of the San Francisco District, enough were. And it is to them we owe the debt of groundbreaking relative to seeing what was and what could be in terms of their own environment. For, almost all that was to come in and for the San Francisco District, in one way or the other, had its beginning in that period between American acquisition and the turn of the century. The exceptions were flood control and reservoir projects. But even these were the natural extension of the Corps' existing concern and policy for the welfare of the populace and water resource development.



Chapter V

Growth



President William McKinley's message to Congress on December 3, 1900, emphasized the theme of individual and national prosperity. He reminded the lawmakers that with the outgoing of the old and the incoming of the new century, good Republican institutions were growing in strength and power. Most Americans felt that it was a time of peace, prosperity and progress. Optimism and self-confidence were loose on the land; Americans didn't merely hope for the best, but fully expected it. And, even if a welter of moral and legal difficulties frequently smeared the image, an unshakable faith in the inevitability of their progress as individuals and as a nation held sway. Labor problems, teeming slums, corrupt politicians and the offenses of ruthless corporations; these and other manifold troublesome issues would, in the minds of most, be resolved in the normal course of events. Meanwhile, the important thing to do was to get ahead by earning maximum returns from one's bountiful opportunities.

America at the turn of the century was a very different country from the colossus it was to become. In 1900 there were only 76 million people living in but 45 states. The average American worker earned 22¢ an hour — and worked a 60-hour week. If you were white, you could expect to live 47.3 years and, if non-white, 33 years. Among the top ten killers of the era were influenza, pneumonia, tuberculosis, diptheria, typhoid, malaria, measles and whooping cough. There were only 8,000 automobiles registered in the United States, and trucks and buses weren't even invented by then. Only 18 of every 1,000 people owned a telephone and no one had even heard of radios, refrigerators, televisions, or most of the other symbols of modern domestic consumership.

The largest occupation in America was agriculture, for nearly 11 million people were farmers. Times, however, were changing. Over six million men and women were employed in factories. In the 35 years since the Civil War, a predominantly agrarian country had jumped from fourth to first place among the industrial powers. In 1900, 60 per cent of our population still lived on farms or in communities with less than 2,500 inhabitants, but that percentage represented a nationwide shrinkage over the previous three decades. The drift to the cities was irreversible despite the appeal of country and small town living. The cities bulged upward and outward, with skyscrapers, apartments, mansions, slums and grimy factories. Moreover, it was the cities that absorbed a disproportionate share of the millions of immigrants flooding into the country. Immigration had been so heavy during the 19th century that one third of the people in the United States in 1900 were foreign born or were the children of foreign born.

In the area of transportation, this was the age of railroads and ships. More than twelve hundred railroad companies used 37,500

steam locomotives to haul millions of tons of freight and carry millions of passengers over nearly 200,000 miles of tracks. For countless communities, the route of a railroad spelled the difference between growth and decay. Just as important, particularly in California and the San Francisco District, "the railroad" exercised considerable influence over the economy, municipal growth, agriculture and state legislators.

At the turn of the century, the nation's more than 23,000 commercial ships were carrying millions of tons of cargo and millions of passengers between and among domestic and foreign ports. And, while the total ton mileage didn't approach that of the railroads, it was nonetheless critical to the nation's well-being, and growing as the nation grew. For the Corps of Engineers of the San Francisco District, shipping and the improvements of navigation attendant to maritime trade continued to play a dominant role.

Yet another indication of change concomitant with the new century was the increased concern for, and the appreciation of, our natural environment. This in turn was accompanied by progressive ideology relative to water resources planning, derived chiefly from the principles of the "progressive movement." When applied to water resources planning, these principles meant:

A. Conservation of natural resources for use by present and future generations;

B. Opposition to control of the economy by monopolies and the consequent exploitation;

C. Honest government, with no give-aways of the public domain to special interest;

D. A positive desire to encourage small, independent enterprises such as family-owned farms, mills, ships, processing and manufacturing enterprises;

E. The abandonment of *laissez faire* in favor of a strong Federal Government, intervening in economic life, for the purpose of protecting equality of opportunity and promoting the well-being of the populace.

The 1874 report of the Windom Select Committee marked the beginning of the ideology that was to animate the waterways legislation of the progressive era. The report favored a comprehensive program of waterways improvements that would provide farmers with better transportation rates than were offered by the railroads. It's noteworthy to mention that San Francisco District reports often made reference to railroad and shipping rates relative to river and harbor improvements.

A decade later, Congress passed general navigation legislation ordering that no survey be made of rivers and harbors until the District Engineer ascertained that the project requested was worthy of federal expenditures. It will be recalled that many of the preliminary examinations carried out on the Pacific Coast harbors received negative recommendations and hence no formal survey or improvement was made. This was precisely in step with the spirit and intent of this 1884 law—neutralization of political factors that ended up in costly surveys.

In 1899 the Corps of Engineers' regulatory responsibility concerning bridges, wharves, channels and harbors, and deposits of refuse materials in navigable waters was expanded. The new legislation was extremely specific in regard to the protection and preservation of navigable waters. From then on, it was illegal to deposit material in, or dredge material from, any such water without a permit from the Corps of Engineers. In addition, a permit was needed to place structures over navigable waters. These included wharves, bridges, dolphins, booms, weirs, breakwaters, bulkheads, jetties and similar works. In general, the District Engineer had the authority to permit applicants to build in navigable waters if he believed it would constitute no threat to the waterway itself or to navigation interests.

President Theodore Roosevelt, an avowed conservationist, had a great deal of respect for the opinion of non-political experts. Thus, much of the innovative thinking in natural resource problems by the progressive conservationists emerged from reports of official study commissions. Reports from the following three commissions are usually considered examples of the ideology of the time, and results from it.

The Inland Waterways Commission (I.W.C.) reported in 1908 on its survey of waterways, commercial navigation and other water resource uses and problems. The commission recommended that federal rivers and harbors improvement reports take into account all the uses of water that might be benefited by the proposed project, including flood control, water power, irrigation, and even the control of pollution.

Another recommendation stated that both national and local benefits be considered in planning to assure the equitable distribution of costs and benefits. The commission also thought that plans for waterways improvements should take into account the relationships between rail and water transportation so as to best serve the public interest. Finally, the I.W.C. wanted to see the creation of a National Waterways Commission, that would coordinate the efforts of various federal agencies doing waterways work.

The National Conservation Commission, another of Roosevelt's creations, submitted its report to the President in 1909. The section dealing with water resources called for extensive hydrological research to support plans for multi-purpose project.

The National Waterways Commission, created by the River and Harbor Act in 1909, completed its initial report in 1912. This joint commission wanted: specific navigable improvements; legislation to

regulate public wharves and terminals; prevention of the deforestation of lands bordering mountain streams; and laws to promote water power development in both the public domain and on navigable streams while controlling such development in the public interest. Finally, it advocated a federal reservoir system for flood control. The cost of this system could be justified, the commission felt, in view of the multipurpose benefits that would accrue. Many of the recommendations proffered by these commissions eventually found their way into laws that governed the activities of the Corps of Engineers.

The review function of the Corps was expanded in 1902, when a national-level Board of Engineers for Rivers and Harbors was established to reduce congressional approval of unsound projects. The Board was to review all reports on preliminary examinations, surveys, projects and changes in projects, and then to make recommendations to the Chief of Engineers. Among its responsibilities, the Rivers and Harbors Board was required to evaluate the commercial potential of proposed improvements and to relate it to the cost of building and maintaining the projects. In the main, the Board was successful in culling unworthy proposals from the lists of improvements to be completed.

The River and Harbor Act of 1910, and the procedural legislation that followed it during the next few years, required that surveys of navigable streams include stream flow measurements and watershed data for planning purposes and consideration of all uses of the streams that would affect navigation. In addition, examination and survey reports had to address the prospective commercial importance of the project, the existence of and need for private and public terminal facilities on the waterway, and information about water power and use. The latter was to be considered only where it was possible and desirable to coordinate such development with navigation improvement. During the early years of this new legislation, the Corps continued to view water power development as a byproduct, to be considered only after a navigation project had been approved on its own merits.

One of the truly signal pieces of legislation passed during the progressive era, and responsible for the growth of engineering authority, was the Flood Control Act of 1917. This act provided that all provisions of existing law relating to examinations and surveys, review by the Board of Engineers for Rivers and Harbors, and expenditures of funds for rivers and harbors projects should apply as well to flood control improvements. Moreover, it provided that at least half the cost of levees put up for flood control must be assumed by local interests or the state. This was a departure from existing law relative to rivers and harbors. In the case with these, Congress retained the discretion over local contributions relative to the amount that was to be contributed by local interests to an improvement.

The 20 years of progressive ideology were followed by a dozen years of Republican ascendancy, from 1921 to 1933. During this period, the executive branch rejected the anti-monopoly and economic

redistribution concerns of the 1901-1916 period, because in its view, "progressivism" was potentially destructive to the country's prosperity and economic growth. So the three post-World War I administrations concerned themselves with removing the government from competition with private industry. Even so, the ideology of the progressive period continued, against opposition, to influence water resources policies and programs.

In 1925, Congress directed the Corps of Engineers and the Federal Power Commission to jointly prepare a list and to submit an estimate relative to the cost of conducting examinations and surveys of navigable waterways on which power development seemed practicable. The overriding objective was the development of general plans for the effective improvement of these streams for the purposes of navigation in combination with development for power, flood control and irrigation. The list that resulted from the directive was submitted to Congress in 1927, and printed in House Document 308. The River and Harbor Act of 1927 authorized the Corps of Engineers to carry out the surveys. These became known as the "308" reports.

Prior to 1920, river and harbor legislation had simultaneously authorized planning or construction and also appropriated the funds for the same. After 1920, separate authorizing legislation was enacted whereby appropriations were made in annual lump sums. Eventually this led, beginning in 1944, to enormous authorization acts in which projects were (and are) frequently authorized years before contemplated construction was to begin.

Though still dependent upon Congress for authorization of projects and appropriations, the Corps' general investigatory authority contained in the 308 reports constituted considerable delegation of power. From 1927 on, the Corps of Engineers was authorized to make general plans for all river basins in the United States.* In fact, if Congress didn't order otherwise, the Engineers could set their own priorities for the completion of the 308 studies. This authority was expanded and strengthened in 1935, when Congress authorized the Corps of Engineers to bring existing 308 surveys up to date and then to complete additional studies where they thought it necessary in terms of the changes in economic factors and additional stream-flow records or other relevant data. This literally amounted to receiving continuing authority to undertake nationwide framework river basin planning. The emphasis would remain on navigation, but flood control was quickly gaining ground.

The significance of the 1935 act and the one that followed in 1936 was that they inaugurated a national flood control program and assigned this to the Corps of Engineers. The 1936 Flood Control Act also authorized numerous reservoir projects for navigation, flood control and related purposes.

Another important evolutionary component of the 1936 act was that known as the "benefit-cost ratio." The widespread use of

*The Colorado River was under the jurisdiction of the Bureau of Reclamation, and thus not included within the Corps' authority at that time.

benefit-cost analysis to weigh an improvement's value is generally thought to have evolved from section I of the Flood Control Act of 1936. This section provided that the government should improve, or participate in the improvement of, navigable waters for flood control purposes if the benefits — to whomever they might accrue — were in excess of the estimated costs of the improvements. And, even though the directive really only applied to flood control projects, the Corps of Engineers soon adopted the concept for use on all its improvements.

The surveys and projects outlined by the 308 reports and subsequently authorized by legislation of 1936 and 1938 were vast in scope, and would take more than 20 years to complete. But even so, the true significance of these benchmark enactments lay in the fact that they provided much of the basis for water resources development within the San Francisco District during the New Deal era and the post World War II period.

The New Deal inherited a predisposition to favor policies of conservation and promotion of public works. But New Deal planners insisted that all water resources projects be related to and coordinated with plans for comprehensive development of entire river basins. Multi-purpose projects were championed in light of this concern, because they combined regional economic growth with widespread distribution of benefits among the people. Finally, the New Deal progressed farther in its involvement with planning than the progressive movement had. Planners were now interested in conservation, not for its own sake, but as an essential element of general economic planning.

The next piece of legislation of commanding note was the Flood Control Act of 1944. As the Second World War began winding down, fear of widespread post-war unemployment surfaced. To counteract such an eventuality, unprecedented numbers of projects were authorized. Funding for these was authorized throughout the post-war period, and into the 1960s. And despite popular belief about the many public works programs of the 1930s, the programs of the Corps of Engineers and other construction agencies expanded to a greater extent during the 1940s and 1950s than during the Great Depression Years.

The Flood Control Act of 1944 became the Corps of Engineers' new governing policy statement. It set forth statutory procedures for coordination of plans with other federal agencies and state governments. Defined was the Corps' jurisdiction over flood control works so as to include channel and major drainage improvements. By this Act, the Chief of Engineers was authorized to construct, maintain, and operate public park and recreation facilities in connection with reservoir projects.

So, from the "Square Deal" of Theodore Roosevelt, through the "New Deal" of Franklin D. Roosevelt, the Corps of Engineers of the San Francisco District consolidated their initial gains in the public's interest and, building upon this foundation, expanded and grew as the nation grew. Using their enlarged authorities to meet increased

responsibilities, the Engineers pioneered new frontiers in the fields of water resource planning and development, and also assumed a more generous portion of the burden for conserving and protecting the environment.

Rivers and Harbors 1900-1950

At the turn of the century, the San Francisco Bay area remained the social economic heart of the Far West. Ocean liners, transports, coast-wise schooners, tall-masted sailing vessels, ferryboats and river steamers were transporting millions of tons of cargo and thousands upon thousands of passengers to San Francisco and the rapidly growing number of satellites that were then beginning to enswathe the bay's shores. The largest and most demanding of these was Oakland.

Oakland

By 1900, the original project as drawn up and begun in 1874 was, with the exception of the tidal canal, just about complete. When begun, the Engineers figured it would cost, in round numbers, $1,815,000, and require thirty years to complete. Over the years, the initial plans were modified to allow for the physical, legal and technical barriers encountered. While unforeseen entanglements slowed the work, the Engineers' technological breakthroughs more often than not compensated for lost time. Deviations from the original design were modest, yet important, and usually carried out in an informal manner. In 1874, dredging was begun in the tidal basin by the first hydraulic dredge ever constructed as well as by the first ladder dredge. Moreover, the original jetties had to be raised higher than first thought necessary to achieve the desired tidal effect. The natural scour hoped for didn't occur, so additional dredging had to be undertaken. But to keep the cost within, or at least close to original estimates, the Engineers sold the spoils material to land-fillers. The idea put forth, but later abandoned, was that of constructing a dam and tide gates at the mouth of San Leandro Bay. By this device, the Engineers expected to double the natural tidal prism of San Antonio Estuary, and the scour thus induced would obviate a large amount of primary dredging and do away with the necessity of constant dredging in the future. It was finally learned that tidal scour had practically no effect on the project, so the dam/tidal gates plan was given up and further dredging done to secure depths originally contemplated. But even with design changes and related problems, the Corps of

Whalers anchored in the Oakland Estuary – 1885. At the time this photograph was made, San Francisco Bay was the chief whaling port in the world.

Engineers had spent less than $2 million on the improvement to that time.

The commerce of Oakland Harbor had increased enormously during the 26 years in which the facility was in the process of construction. From 1874 to 1900, commerce entering and leaving the harbor increased from 154,000 tons to about 3 and a quarter million tons — fully twenty-fold. From a cost-benefit ratio, this meant that there was an annual increase of 1.6 tons of goods shipped for every dollar spent. Few harbors could show a better record.

Clearly, the existing harbor was in need of re-examination with a view towards enlargement to handle the newer and larger vessels using the port. Oakland newspapers, reflecting the sentiments of shippers and commercial firms, called for a channel having at least 25 feet of water to permit ships carrying wheat, sugar, and coal, and other large vessels to use Oakland Harbor. Further justification for enlarged facilities was brought forward in terms of the steadily increasing numbers of ships that had to be turned away from the port of San Francisco. It was claimed that, even though wharf facilities at San Francisco were indeed substantial, the tremendous volume of maritime trade seeking dockage there could not be satisfied. So, besides meeting the expanding needs of Oakland itself, improvements would relieve pressure on the bay's chief port as well.

In reponse to the emergency River and Harbor Act of June 6, 1900, the Engineers from San Francisco, under the direction of Colonel Heuer, conducted a preliminaruy examination of Oakland Harbor. This was followed by more extensive surveys, which resulted in the first formal modification of the project.

The Engineers submitted three alternate proposals. The River and Harbor Act of 1902 authorized modification but failed to specify which plan was to be completed. Finally, the 1905 act authorized (Plan 3) a channel 500 feet wide and 25 feet deep from San Francisco Bay to Chesnut Street, a channel 300 feet wide and 25 feet deep from Chesnut Street to Fallon Street, a channel 300 feet wide and 17 feet deep from

Fallon Street to the tidal basin, and a channel 300 feet wide and 12 feet deep completely around the tidal basin. Estimated cost for the new work amounted to $968,000.

The project was modified further in 1907 by providing for extension of the south jetty, some 500 feet, widening to 500 feet the channel 24 feet deep from San Francisco Bay to Fallon Street, deepening to 25 feet the channel 300 feet wide from Fallon Street to the tidal basin, deepening to 17 feet the channel 300 feet wide around the north side of the tidal basin to the tidal canal and from the tidal canal along the Alameda shore to 10th Avenue. The estimated cost for this came to $1.5 million. But even before this work was completed, the scope of the project was again enlarged.

A part of the original project and the subsequent modifications that proved troublesome over the years was the construction of the tidal canal. It was first thought that the area needed for the canal would be deeded to the government free of cost. In the end, the land had to be acquired by condemnation, at a cost of $39,000. In addition, six years elapsed from the time proceedings began until the final decree was rendered. Part of the court settlement demanded that the government build and maintain suitable railway and highway bridges at all existing rail and road crossings. At the time, there were three highways and two railways crossing the line of the proposed canal. Steel highway bridges were built across the canal at Park Street and at High Street. A combined highway-railway bridge was put across the canal at Fruitvale Avenue, and for the better part of a year, the Corps of Engineers negotiated with the Central Pacific Railroad Company with a view to purchase a release from the company relative to building another railroad bridge that would run diagonally across the canal at Washington Street. There was daily train traffic over the routes to be occupied by the railway bridges and this meant the construction of temporary tracks (at additional expense to the government) would have to be built before permanent bridges could be constructed, or else interference with navigation would take place during the

The San Rafael, *at left was built in New York for the North Pacific Coast Railroad and shipped in sections to San Francisco for reassembly. She operated on the bay until 1901, when she went down after a collision with the* Sausalito.
The Amador, *center, is shown leaving San Francisco heading for Oakland. She was eventually rebuilt as a single ended river boat and remained in ferry service until 1904.*

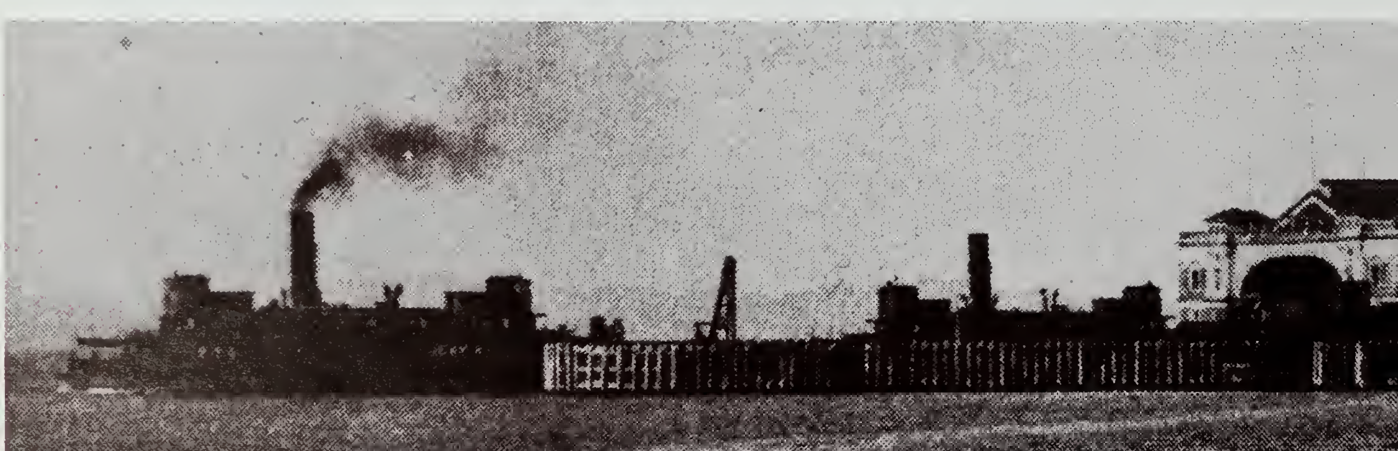
District Engineer 1907-1911
Lt. Col. John Biddle

construction phase. The Engineers hoped that, for a reasonable monetary consideration, they might be able to avoid the construction and maintenance of a steel railway bridge over the tidal canal at Washington Avenue. As it worked out, the matter of completing the canal had to be deferred until the situation relative to the bridge was settled. In the meantime, the city of Alameda had constructed its sewers with outfalls near the junction of the tidal basin and the tidal canal. This created an immense cesspool, which produced horrible stenches. The people of the area immediately began clamoring to Congress for relief.

In May of 1909, the High Street Bridge was almost completely destroyed by fire, and took until January, 1910, to rebuild. That same year, the three bridges over the tidal canal, according to the River and Harbor Act of June 25, were to be transferred to local authorities for operation and maintenance. Prior to transfer, however, the government was to generally put them in good repair and install electric motors to move the bridges. To this point, the tidal canal had never been thought of as a navigable waterway, hence the bridges were never moved to make way for shipping. But with the growing trade of the port, local interest determined that if the canal were deepened, the bridges improved, and the waterway made a contiguous navigable section of the harbor, marked commercial benefits could be derived.

The request for such improvement was accompanied with the offer by local interests to take over, operate, maintain and replace when necessary, all three of the canal bridges, if the government would deepen the canal and otherwise make it a fully navigable waterway. Congress approved this deal, and the local interests assumed full responsibility for the three bridges in 1913. Things went fairly well for many years under this arrangement. But, in 1939, the County initiated court action that resulted in the voiding of the agreement relative to the Fruitvale Avenue Bridge. The action was prompted by the fact that the County was spending funds for the benefit of a private railroad company in operating and maintaining the bridge with its combined railroad crossing. In 1942, the courts ordered the bridge to be returned to the government (Corps of

The Fernwood *leaves the Key Route Pier at Oakland while electric trains await passengers – right of photo. From 1903 until just prior to World War II, the Key Route presented the Southern Pacific Company its stiffest competition for transbay passengers.*



Engineers) for operation and maintenance, which it was. This, however, didn't end the controversy. The issue would be argued in the courts for years, and wasn't finally settled until the early 1970s.*

Though the problems related to the drawbridges proved troublesome for years, they didn't significantly affect the growth of the port or the attention paid to improvements by the San Francisco District. Even before the 1907 project was completed, it was upgraded by another in June, 1910.

In his report of 1909, District Engineer Lieutenant Colonel John Biddle, reviewed the progress made at Oakland and suggested that additional work be planned to meet the expected future needs of the port. As finally adopted in 1910, the new plan authorized a channel 500 feet wide and 30 feet deep at mean low water from deep water in San Francisco Bay through the Oakland Estuary to Brooklyn Basin, a distance just short of 5 miles, 300 feet wide and 25 feet deep around the basin and 18 feet deep through the Oakland Tidal Canal to San Leandro Bay, a distance of about 4 and a half miles.

Just as Oakland was growing and prospering, so were her neighboring communities located along the east shore of the bay. Berkeley, Richmond, and to a lesser extent, San Leandro, Emeryville and Albany each wanted its own deep water facilities, and pressed the San Francisco District to draw up plans to provide for these. In reponse to these demands, Colonel Thomas H. Rees, District Engineer, examined the situation and came forward with a plan for the comprehensive development of the harbor requirements of the entire

*In 1951 the San Francisco District constructed a new railroad bridge and converted the old bridge to handle only vehicles. The 1962 River and Harbor Act authorized reconstruction of the bridge. The project was meant to provide a two-lane movable bridge adequate for the authorized 25-foot navigation project, at an estimated cost of $1.8 million to the Federal Government. This was contingent upon certain contributions by local interests.

Subsequent inspections revealed that rehabilitation of the old bridge was not feasible. In the interest of public safety, design and construction of a four-lane bascule bridge was authorized as an item of maintenance at an estimated cost of $4.3 million. The new vehicle bridge was completed in 1973 and accepted by local interests for operation.

Fruitvale Avenue Bridge – 1901.

Sketch of the new Fruitvale Avenue Railroad Bridge.

East Bay region. Taking for granted the economic necessity for increased and better harbor facilities, Rees went to the heart of the issue. Where could such facilities be provided to the best advantage for the least expense? He was opposed to building more long wharves into the bay to reach deep water, on the grounds that construction and maintenance costs were high and because such appliances carried commercial activities far out into the bay, away from city streets, business centers and residence districts. This type of construction developed no land and encouraged no industrial enterprise except through transportation.

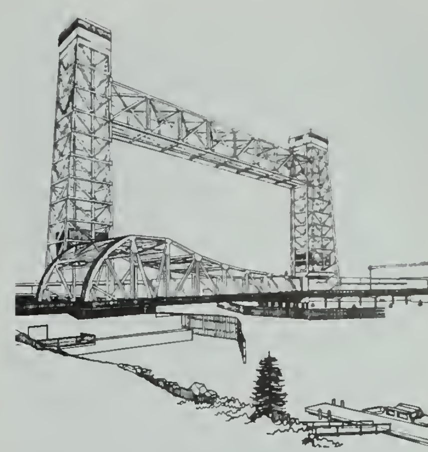
For Rees , development should be land based. He recounted that the East Bay cities had a large and growing population, good city governments, extensive business and industrial interests, active civic organizations, excellent rail service, and plenty of land to develop and on which to build. Moreover, the whole area enjoyed an unequalled climate and great fertile and productive agricultural regions. Best of all, it was located directly across from the Golden Gate.

Unfortunately, the cities were blanketed from the deep draft commerce of the ocean and bay by wide mud flats extending for miles from the shore, rendering the frontage useless in its then present condition.

Rees felt it manifestly unwise to attempt to provide a separate and disconnected deep harbor for each of the localities for two reasons: the expense would be prohibitive and the mutual and supporting interests of the communities would not be promoted. He believed that (1) the East Bay should be seen as a total unit in terms of development and (2) the best utilization of the advantages of San Francisco Bay as one great harbor should be considered rather than special benefits to any one locality.

In May, 1913, he submitted his plan to the Chief of Engineers and to the community leaders of the East Bay. His overriding objective was to outline a scheme which would serve as a guide for future progressive development by any of the interests of localities concerned, and would prevent the building or continuance of structures that would block or interfere with the future execution of the general plan. Reduced to its essential elements, the Rees plan called for a deep channel beginning in deep water off the entrance to the Oakland Estuary and extending approximately parallel to the shore front of Oakland, Emeryville, Berkeley, and Richmond to deep water at Point Richmond. The channel would be protected by a dike and fill on the outer side parallel with the channel. Dredged material from the channel would be placed behind a bulkhead to as to fill up and reclaim the land between the channel and the shore, and would also be used to build the dike. To keep the cost of the project in line and to promote commercial interest, the reclaimed lands would be immediately offered as commercial, industrial and manufacturing sites.

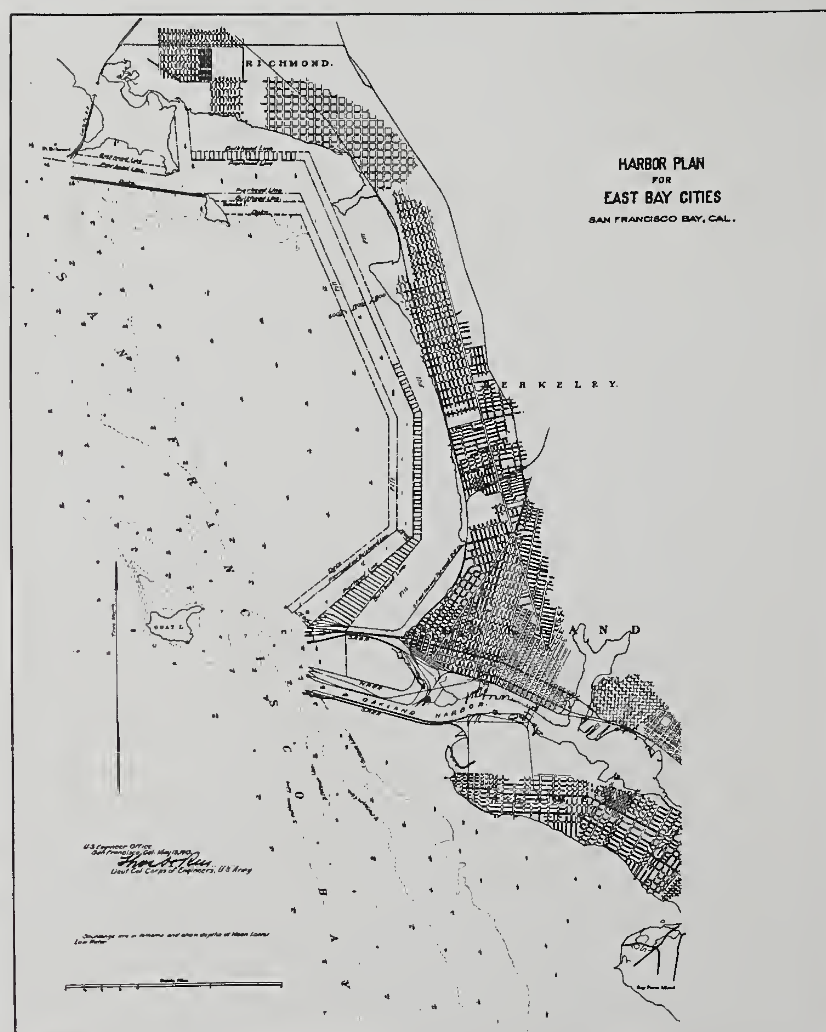
If it had been completed as Rees envisioned, a continuous, protected deepwater frontage would have extended from Point Richmond to San Leandro Bay, a distance of about 19 miles. Upon its



This single-leaf bascule bridge design was originally chosen by the Corps of Engineers as the most feasible four-lane replacement of the old Fruitvale Avenue Bridge. The final design was completed with no superstructure. The twin-towered structure is the railroad bridge. In February 1974, the Fruitvale Avenue Bridge was re-named the Miller-Sweeney Bridge to honor Congressman George P. Miller.

District Engineer 1911-1917
Col. Thomas H. Rees

presentation, the plan apparently met the approval of all the communities involved, but later objections were raised and alterations suggested that brought consideration of the comprehensive scheme to a standstill. By 1917, the various communities had decided to press their individual causes, ending the possibility of mutual agreement for overall development. Oakland and Alameda had developed miles of wharves, docks and warehouses on their respective sides of the harbor. On the inner harbor alone, there were five Ferry terminals, eight shipbuilding plants and more than 50 freight wharves. And besides all of the dredging done by the San Francisco District, the City of Oakland expended a million and half dollars on dredging and related harbor development costs prior to American involvement in the First World War. The Southern Pacific Railroad and other companies were also making extensive harbor improvements in the area.



Harbor Plan – East Bay Cities

Even so, private concerns wanted the government to further improve the inner harbor on their behalf. The Union Iron Works Company, the Alaska Packer's Association, Barnes and Tibbitts Shipbuilding and similar companies, on both sides of the harbor, led the fight to get the Corps to deepen and widen the project.

On the outer Oakland harbor area, the improvements had been more in the nature of temporary expedients to gain access to deep water and consisted of moles and piers built out across the tidal flats (mud flats) from one to three miles in length. Each had been made independently, and without regard for a general comprehensive plan of development for the whole frontage. Such improvements had many disadvantages. Besides being temporary in nature and expensive to build and maintain, such appliances were guilty of what Colonel Reese wanted to avoid relative to other East Bay sites. Shipping was necessarily located far out in the bay away from business centers. Only limited facilities could be provided in comparison with the great lengths of piers required and made no allowance for the social and economic development of the immediate vicinity adjacent to the facilities. In this method of improvement, the Corps of Engineers had no interest other than the establishnment of the required harbor lines.

These piers and moles cut up Oakland's outer harbor frontage into so-called basins. The Southern basin was situated between the north jetty at the entrance to the San Antonio Estuary and the Oakland (Southern Pacific) Mole. While this basin was owned by the City of Oakland, all of it, with the exception of a central strip, was under lease to railroad companies. Their 50-year franchises called for specified amounts of wharf construction and dredging, with the provision that at the end of the franchise period, the control of the improvements would revert to the city.

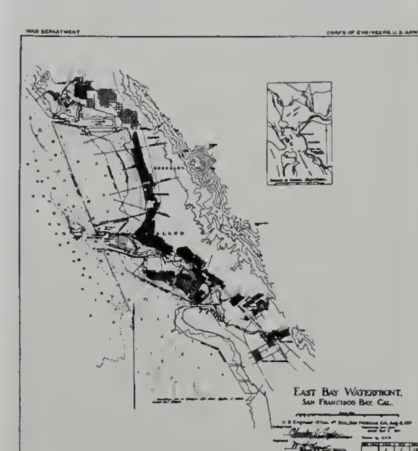
To the north of this basin, and lying between the Oakland Mole on the south and San Francisco and Oakland Terminal Railways (Key Route) pier on the north, was the Key Route Basin. The City of Oakland and the Key Route system began developing this area in 1913, and by 1917, they had made considerable progress regarding dredging and wharf construction.

During this same period, the company, under permits granted by the San Francisco District, constucted a solid fill along the north side of their franchise line for a distance of about two miles out from the shore line. It was hoped that this solid fill and subsequent development of the adjacent basin would eventually be incorporated into the overall harbor development plan, as outlined by the Corps in 1913.

A review of the development of the East Bay communities suggests two reasons for their being. The predominate one was their growth as residential settlements for persons working in San Francisco. Conditions favoring this feature were the pleasant climate, extensive and favorable areas for residential development and the easy access provided by the extensive trolley and ferry systems. It was estimated that the ferries plying the bay between San Francisco and the East Bay cities during the period of the First World War carried a daily

District Engineer 1919-1920
Col. Charles L. Potter

East Bay Waterfront.



average of 100,000 persons.

The other reason for the development was the extensive commercial and industrial activity, especially at Oakland and Richmond, due to the location of these cities on the great continental railroads and their proximity to San Francisco Bay. And, according to the Corps' reasoning at the time, a gradual expansion of the trolley and ferry service would suffice for the near future development of the region. On the other hand, if full development was to be realized, deep water would have to be provided along the entire waterfront.

Still, the San Francisco District wasn't quite ready, following their survey at that time, to recommend further development. Three reasons can be identified for their reluctance to agree to expanding the basic (1910) 30-foot project in 1917. One has already been cited—the view that development should be comprehensive and not piecemeal. Besides this, the commerce had dropped from four million tons annually to three million tons. The reasons for the decline were due partly to the diversion of overland freight by way of the south bay Dumbarton Cut-off directly to San Francisco and partly to the lack of ships due to the European War. Finally, it was estimated by the Engineers that 75 per cent of the commerce was local freight and the other 25 per cent, consisting chiefly of lumber and coal, was largely coastwise traffic. Fully 95 per cent of the commerce of the harbor was carried in vessels drawing not more than 22 feet when loaded. For the Corps of Engineers then, in the period 1917-1918, the existing project for the inner harbor and the proposed development by the local interests of the outer harbor provided ample navigation facilities for the present and foreseeable future.

Following the end of the war, the area began to experience a moderate, steady growth. Once again, local interests asked the San Francisco District to conduct a preliminary examination and, if deemed appropriate from this, to carry out an in-depth survey of the harbor with a view toward further improvement. It should be noted here that, while the total commerce of the port seemed to still be declining, much of the reduction is attributable to the method of accounting. The commerce reported for 1920 amounted to 1.7 million tons, apparently less than for a number of years. Prior to 1920, there was included in the general statement of commerce the tonnage of automobiles, wagons and other vehicles crossing between San Francisco and Oakland. After that year, they were accounted for separately as ferry traffic. If they were added to the amount reported for 1920 and the years following, the aggregate would show that the commerce was being fairly well maintained. In point of fact, the port was experiencing increased ocean-going traffic.

Even the Board of Engineers for Rivers and Harbors, while on the Pacific Coast in October, 1920, was impressed with the amount of business evident in Oakland, particularly in the inner harbor. There were many vessels loading and discharing cargoes and the dozens of wharves were nearly all occupied. The various industries lining the harbor, including shipbuilding and repair plants, presented an air of business activity, while the number and size of vessels suggested the

Oakland Harbor – 1917

need of greater width of channel and the provision of increased dimensions further inland. Another obvious situation that needed to be corrected was the shoal southeast of Yerba Buena (Goat) Island which presented a detriment to the development of Oakland Harbor.

Local interests, no doubt, accompanied District Engineer Colonel Herbert Deakyne and the Board on at least some of their inspection tours of the facility to point out the specific improvements needed. In addition, public hearings were held in Oakland, Berkeley and Albany, where arguments were heard and plans presented by concerned parties. Colonel Deakyne also held a number of consultations in his office to secure the widest possible opinions on the subject. Specifically, the local interests wanted the San Francisco District to:

1. Dredge a channel across the shoal southeast of Yerba Buena (Goat) Island;
2. Deepen and widen the channel from the entrance of the Webster Street Bridge;
3. Deepen and widen the channels through Brooklyn Basin;
4. Dredge channels in East Creek Slough and along the north shore of San Leandro Bay;
5. Deepen and widen the channel through the Tidal Canal;
6. Dredge entrance channels in the outer harbor, from deep water to the Key Route and Southern Pacific Basins;
7. Dredge an entrance channel to Berkeley Harbor.

District Engineer 1920-1925
Col. Herbert Deakyne

After listening to all concerned, Colonel Deakyne completed his preliminary examination and filed his report with the Chief of Engineers in December, 1921. He concluded that the locality was worthy of additional improvement to the following extent:

1. In the area of the Oakland Harbor, a channel through Goat Island Shoal 30 feet deep and 800 feet wide, narrowing to 600 feet at the ends of the Oakland jetties;
2. A channel from the outer ends of the jetties to Webster Street, 30 feet deep and 600 feet wide generally, and widened in front of Municipal Wharf to the pierhead line;
3. South Channel, Brooklyn Basin, 30 feet deep and 500 feet wide;
4. The turning basin at the east end of Brooklyn Basin 30 feet deep, 500 feet wide, and 1,200 feet long;
5. Increasing the Tidal Canal Channel to Park Street 30 feet deep and 275 feeet wide.

The District Engineer recommended that any improvements carried out in the inner harbor be made contingent upon the condition that suitable right of ways and spoil areas be provided free of cost to the government and that other specific requirements be satisfied.

Deakyne reasoned that a channel across the shoal southeast of Yerba Buena (Goat) Island would provide a deep water entrance to both the inner and outer Oakland Harbors. It had to be at least 800 feet wide, in that it could not be marked by buoys because of the danger of the buoys being struck by the paddle wheels of the ferryboats during periods of fog. He felt that the channel entrance should also be widened, to lessen the risk of ships grounding while attempting to make the entrance, a situation that was occasionally happening with the increase in traffic.

District Engineer 1925-1927
Maj. John W. N. Schulz

Deterioration of the channels in Brooklyn Basin had been quite severe over the years and hence were in need of maintenance. An additional consideration here was that the principal channel in the Basin was the south, or Alameda Channel—all vessels going to and from the Tidal Canal used this artery. The north channel, on the other hand, had been little used and the frontage there was developed to only a limited extent. Moreover, by 1915, the question of finding adequate dumping grounds for all of the dredged material became acute. To secure reasonable bids, it was necessary for the District Engineer to notify prospective bidders that the middle ground, that area between the north and south channels, was available for disposal of dredged material. Private interests were also using this middle ground for spoils material. As a result, this area became an 80-acre island, with an elevation of from 8 to 18 feet above low water. A problem to be solved later was—who owned the land?

Before long, the United States Shipping Board Emergency Fleet Corporation established a concrete shipbuilding plant on the eastern portion of the island and constructed a trestle between the island and the foot of Dennison Street in Oakland. It was understood that when the concrete tank ship, then under construction, was finished, the

activities of the Fleet Corporation would shut down. Nonetheless, the upshot was that the trestle, which carried a railroad track and a roadway, effectively prevented water traffic from using the north channel.

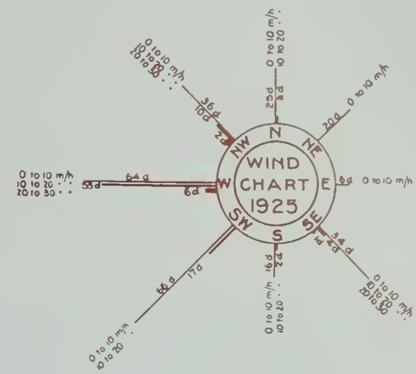
Yet another negative aspect of the north channel was that it divided the tidal flow from the Tidal Canal, part going through each channel, with a consequent loss in velocity, making a favorable condition for the deposition of silt. The Engineers believed, and suggested,that if the trestle was replaced by a solid fill, all tidal flow would go through the south channel and deterioration there would be far less rapid.

In light of development of the island, increased traffic through the Tidal Canal, and the gradually increasing use of the Alameda frontage, the 300-foot width of the south channel would probably soon be insufficient for the needs of navigation. Hence, the need to widen and deepen this channel through Brooklyn Basin and to deepen the Tidal Canal. The Engineers didn't feel that anything further need be done with the north channel, except to restore project depths.

Deepening the Tidal Canal, as the situation existed, would be a problem. The footings of the bridges across the canal extended only slightly below the bottom of the channel and any deepening would necessitate reconstruction, if not replacement, of the Park Street bridge, and replacement of the Fruitvale Avenue and High Street bridges, the latter two having only 63 feet of clear opening. The Corps held that this work should properly be done by local interests as well.

The San Francisco District was, on the whole, impressed with the plans of private individuals for the Berkeley Harbor. All recognized that there was no pressing need for full development of the harbor at that time, in that it couldn't be justified in terms of commerce. Colonel Deakyne pointed out that, in the main, the work contemplated by private interests from Berkeley appeared to be largely a project for land reclamation and development and would require the expenditure of millions of dollars. According to the District Engineer, the desire of the local interests was for the Corps to adopt their plan so that the work would have official sanction and standing. Hence, when the demand for additional facilities on San Francisco Bay, at Berkeley, arrived, whatever work that was done would be in accordance with a plan looking well into the future and piecemeal, haphazard building would be avoided. To that extent, the plan was considered meritorious by Colonel Deakyne.

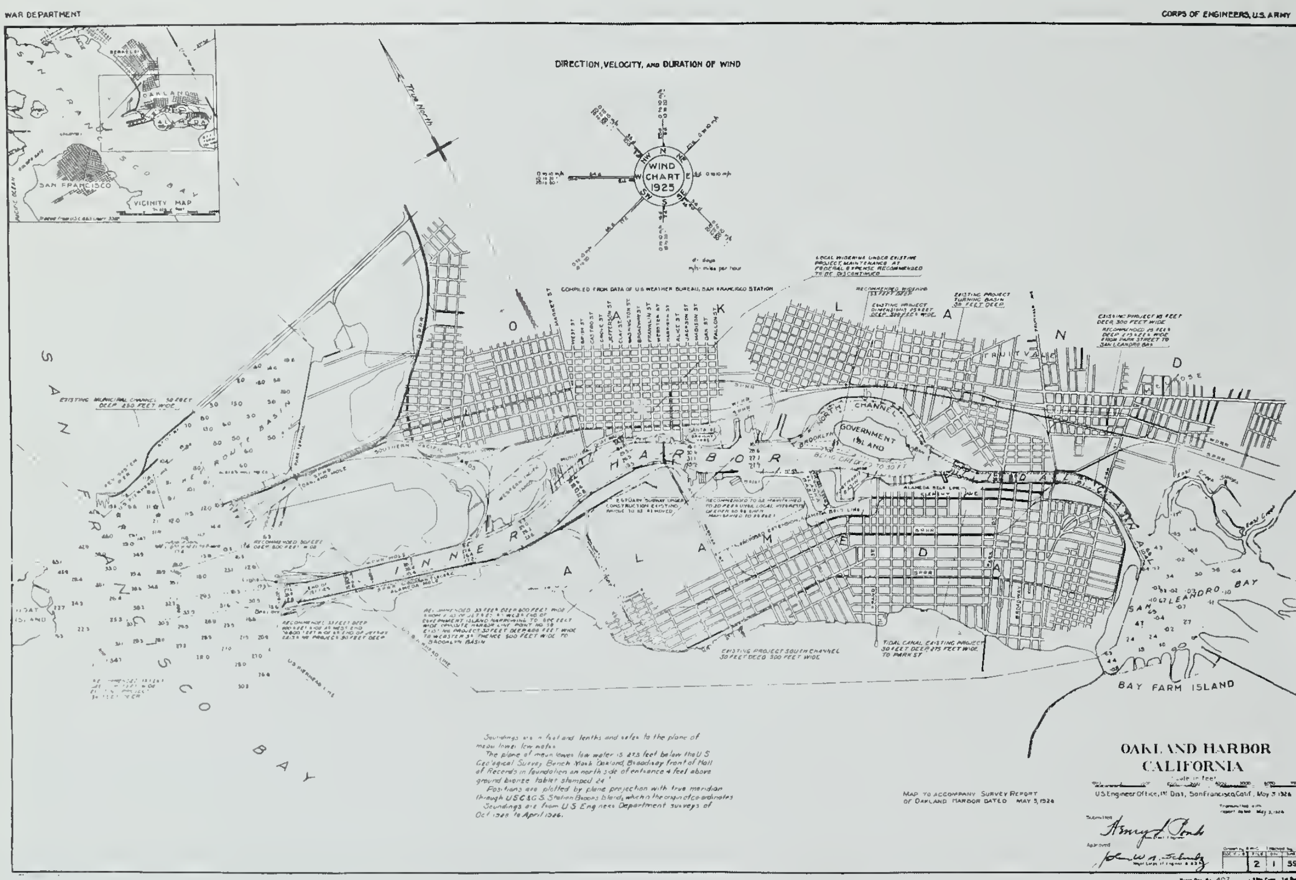
Based on the District Engineer's report and, after concurrence by the Board of Engineers for Rivers and Harbors, a full survey was approved. Then, in September, 1922, Congress authorized the new work. The authorization, however, carried the stipulation that no work be done above the Webster and Harrison Street Bridges until such time as they were removed or altered in accordance with plans approved by the Corps of Engineers relative to adequate provision for navigation. This was later amended by the River and Harbor Act of March 3, 1925, to read that no work would be done above the bridges until the Corps received satisfactory guaranties that the bridges would



District Engineer 1927-1928
Col. T. H. Jackson

be removed, or altered, in accordance with plans approved by the Corps, to provide suitable facilities for navigation.

The work authorized in 1922 was begun in October, 1923. Within a year, more than 70 per cent of the channel widening had been completed. By 1925, more than five and a half million dollars had been spent by the government on improvements at Oakland Harbor. It was estimated that local interests had additionally expended about two and a quarter million dollars for work in the inner harbor.



Oakland Harbor – 1926

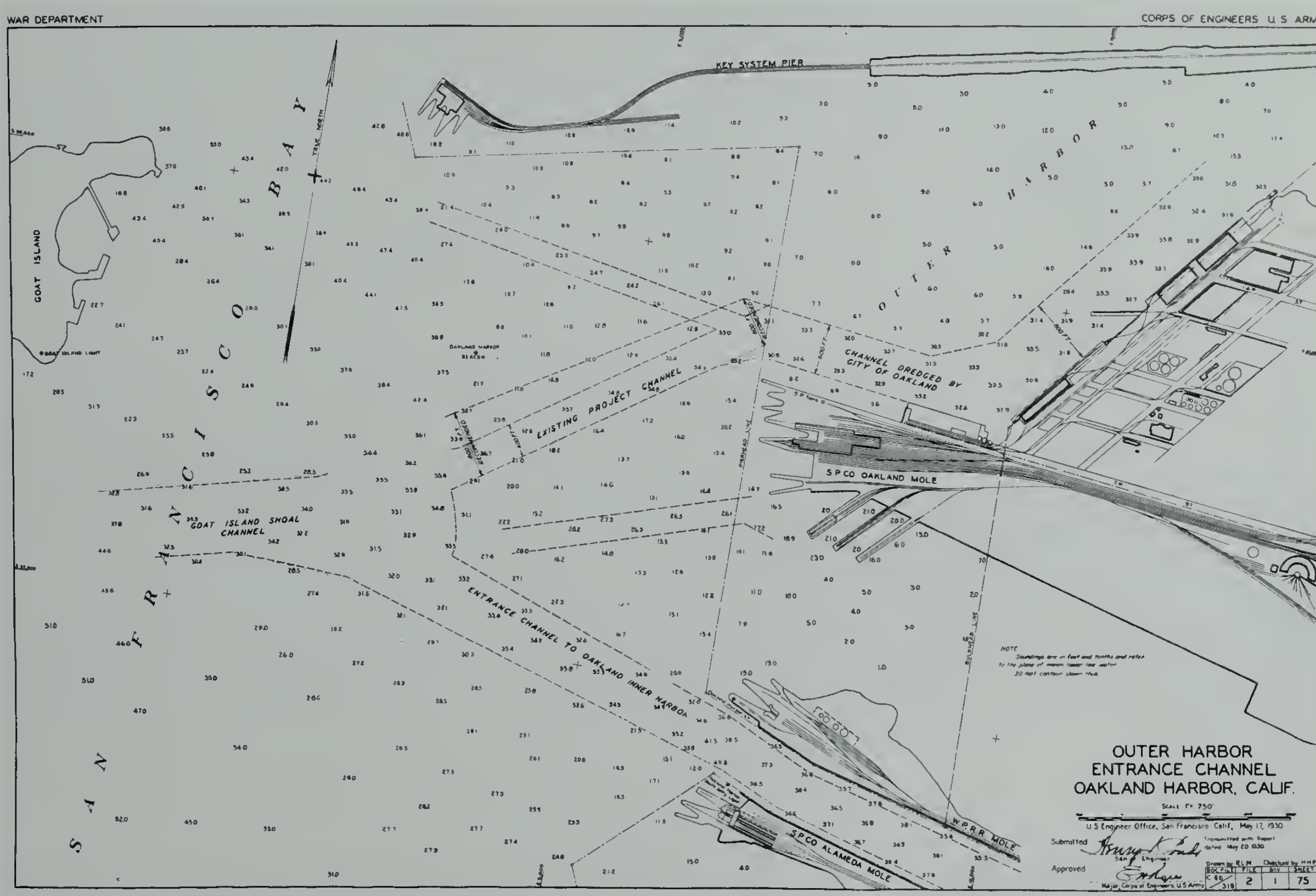
It's interesting to note also that, by this time, the island in the middle of Brooklyn Basin, built up as it was almost entirely of dredged material, was known as Government Island.

As expected, the improvements made by the San Francisco District had a direct and immediate positive effect upon the commerce carried to and from the port. This was especially true in terms of ocean shipping and the size of vessels now able to use the facilities.

By 1930, three times the number of deep-draft vessels were using the port than had been estimated when drawing up plans for the last modification. Increased numbers meant increased problems in navigation. In the outer harbor, groundings were becoming more frequent. This was due partly because the channel was hard to locate. It was hard to locate because of the lack of buoys — which were not in place nor could they be used to mark the channel due to the heavy

ferry traffic. Vessels passing in the channel were reluctant to give way to each other, with the result that one was sometimes forced into the bank to escape a collision. Five groundings of deep-draft vessels occurred in the channel during the first three months of 1930.

The bridges over the inner harbor channel were still causing their share of problems. By this time, the Harrison Street Bridge had been replaced by an underwater tunnel (tube). Even so, the Webster Street Bridge had been wrecked by a passing steamer in 1926, rebuilt



and hit, bumped and damaged many times thereafter. In general, the bridges, because they were slow to operate and afforded narrow passage to ships, constituted a very real hazard to navigation.

Oakland Outer Harbor – 1930

During the next few years, Alameda County replaced two of the three bridges according to plans approved by the Corps, but challenged the Engineers over responsibility for the Fruitvale Avenue structure. As was mentioned earlier, the battle over this bridge would be years in the settling.

In 1927, the Oakland Harbor project was modified further in terms of depth and width of channels and also in terms of increased local contributions to the federal project. An example of the improvements authorized at that time was a 400-foot wide entrance channel to the Key Route Basin, the contract for which had been completed in November, 1929. By 1930, all of the new work was

District Engineer 1928-1931
Maj. E. H. Ropes

District Engineer 1931-1935
Lt. Col. H. A. Finch

determined to be about 70 per cent complete. The project moved along quite smoothly during the next few years, until, in 1934, it was classed as 82 per cent complete, with the only remaining work to be done being the deepening of the Tidal Canal to 25 feet. This would be as far as things would proceed, in the inner harbor at least, for many years.

The slowdown was due to the issues surrounding the jurisdiction of the Fruitvale Avenue Bridge. The difficulty centered on the fact that the Southern Pacific Company operated trains over this bridge. During the early 1940s, the Federal Court decided that a municipality could not contribute funds toward betterment of a private corporation. The issue was partially solved in 1949 when, upon the recommendation of the District Engineer, Congress authorized the construction of a separate railroad bridge.

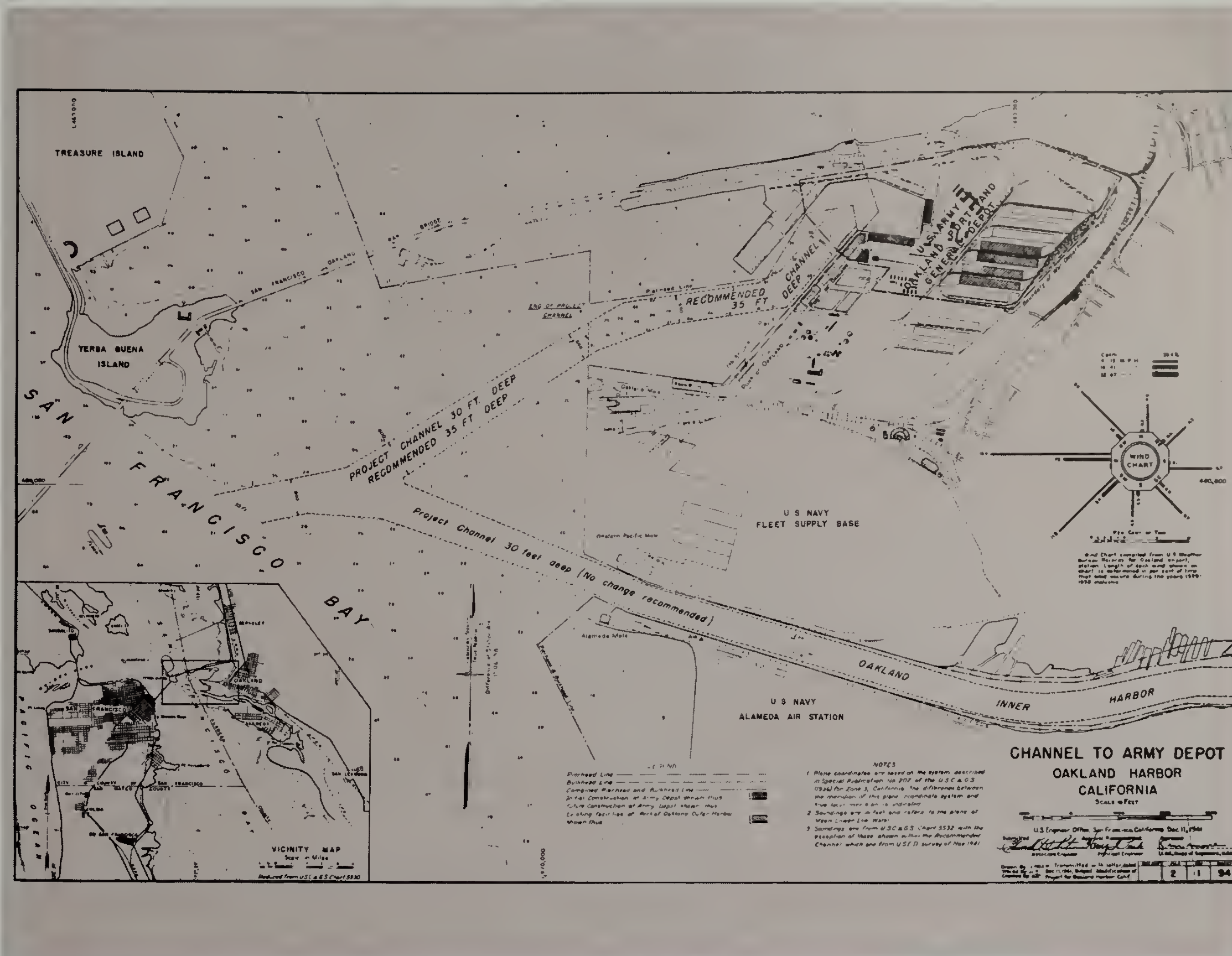
The next profound changes made in the Oakland Harbor area accompanied the deteriorating relationships among the world powers. District Engineer Lieutenant Colonel K. M. Moore, reviewed the situation in a report submitted to the Chief of Engineers in May, 1941.

For years, local interests had been after the Corps of Engineers to dredge a channel through San Leandro Bay connecting the Tidal Canal in Oakland Harbor with San Francisco Bay. As late as 1939, the San Francisco District surveyed San Leandro Bay and submitted an unfavorable report. The improvement desired, and under consideration at the time, was a channel 18 feet deep, either in San Francisco Bay to the foot of Davis Street, San Leandro, or a channel through San Leandro Bay to the Oakland Airport. Having received negative reports over the years from the Corps, the Port of Oakland, between 1928 and 1930, dredged a channel 16 feet deep from the end of the Tidal Canal through San Leandro Bay and thence, in a connecting slough to the Oakland Airport. By 1941, however, no commercial traffic was using the channel and the controlling depth had deteriorated to but 7 feet.

In 1941, Leslie Freeman, manager of the San Leandro Chamber of Comerce, presented a resolution to the Corps of Engineers, which requested that a deepwater channel be dredged through San Leandro Bay, with the express purpose of providing an alternate outlet for Oakland Harbor in the event a saboteur sank a ship in the Oakland Harbor channel and blocked the passage.

Lieutenant Colonel Moore consulted with the port authorities of Oakland and held meetings with the city managers of Alameda and San Leandro and Mr. Freeman. The potential advantages of a new channel and the likelihood that the existing Oakland Harbor channel might be blocked were examined at length. The consensus of the local parties was that they could contribute no funds to the effort.

It was also decided that there was very little likelihood that any attempt would be made to block the existing channel and even less chance that it would be successful if tried. Except for a short stretch opposite Government Island, the least channel width was 600 feet. It was stated during the talks that a tugboat and a large freighter had sunk



in the 600-foot channel at separate times in the past few years, and while shipping had to pass the sunken vessels slowly and cautiously, there was no actual stopping of traffic. It was thought that even if the passage way was successfully blocked, there was ample salvage equipment at hand to clear the channel. The probable cost and inconvenience would be small when compared to that required for an alternate channel. Army and Navy vessels, it was believed, would probably not be in the harbor during threatening times anyway. Finally, on a positive note, the District Engineer recommended that the requirement of the then existing project for deepening the Tidal Canal, which called for the contribution of 10 cents per yard from local interests toward the cost of the dredging, should be eliminated. Colonel Warren T. Hannum, South Pacific Divison Engineer, agreed with the District's position, and so stated to the Chief of Engineers.

While the District couldn't support a new channel through San Leandro Bay, it was very much in favor of providing a channel to the (Army) General Depot, located at the northeasterly extremity of the Oakland outer harbor. In his letter to the Chief of Engineers, dated November 24, 1941, Lieutenant Colonel Moore pointed out that the

construction program then underway at the depot would provide berths for four transports at one time and would be completed about February 1, 1942. He expected that a large number of transports would use the facility after that time.

Practically all of the original dredging in the project channel was to a depth of 35 feet. The channel between the shoreward end of the project channel and the Oakland Depot had also been dredged to 35 feet by private interests, but by late 1941, had silted to where the area was only 27 feet. District Engineer Moore felt that the old channels could be rehabilitated and a new one made by using a hopper dredge. He had, in fact, already had the hopper dredge *Mackenzie* put to work dredging the outer harbor channel (existing) to a depth of 33 feet. Moreover, he recommended that the work to be done in the relationship to the army depot be made a part of the overall Oakland Harbor project. So sure was he of a positive response from Congress that he proceeded with the necessary reports, so as to be in a position to submit them upon receipt of authorization.

Earlier, in July, 1941, the San Francisco District had issued permits to the Constructing Quartermaster to dredge the area near the Oakland Army Port (also known as Oakland Army Port of Embarkation, General Depot, Oakland Depot, etc.) to a depth of 35 feet. The Quartermaster was also dredging parts of the inner harbor to this same depth. The latter was vitally concerned about achieving a depth of at least 35 feet over the entire area. He reminded the Engineers that the Army Transport Superintendent at Fort Mason was operating some 12 transports having a mean draft of 30 feet, 6 inches. The draft aft of these ships was, on occasion, several feet more. Constructing

Oakland Army Depot

Quartermaster Lieutenant Colonel Eismere Walters reiterated a recent problem experienced in bringing the army transport *Taft* in and out of the harbor because of her draft. Walters wanted the harbor deepened and he wanted the work done with all dispatch!

With the events of December 7, 1941, at Pearl Harbor, the earlier perceived need for development in and around the Oakland Army Base was driven home with sledgehammer-like blows. Within a month of the Japanese strike on America's Pacific islands, Colonel Warren T. Hannum, Division Engineer, received an official telegram with word from the War Department authorizing the 35-foot depth for the areas around the port. During the war, the project was modified further relative to deepening and widening the channels in the interest of national defense. Besides extensive maintenance dredging, a new channel 800 feet wide and 35 feet dceep was approved in February 1945.

It is hard to determine the exact costs associated with the development of the Oakland Harbor in relationship to the construction of the Oakland Army Base. The base itself cost millions to complete. Some of the original funding was secured under the auspices of the Quartermaster Corps and included monies for channel development. Soon after the attack on Pearl Harbor, the Corps of Engineers assumed responsibility for all army construction and funding became a mix of military and civil monies — often under emergency situations. It is known, however, that to June 30, 1941, more than $7,800,000 had been expended on new work and maintenance at Oakland by the Corps of Engineers. The following table reflects costs to June 30, 1949.

Total amount appropriated	$9,157,759.23
Cost of new work	5,521,263.24
Cost of maintenance	3,289,983.50
Total net expenditures	8,800,565.19
Unexpended balance	357,194.04
Unobligated balance available	37,359.00
Amount appropriated for FY 1950	1,085,000.00
Total unobligated balance available for FY 1950	1,122,359.00
Estimated additional amount required to be appropriated for completion of existing projects	285,000.00

And what was accomplished for the millions spent? Following is a summary of the improvements:

Acts	Work Authorized	Documents
June 23, 1874	Jetties	Annual Report, pt. 11, 1874, p. 382
June 25, 1910	North channel in Brooklyn Basin and tidal canal to 18 feet.	H. Doc. 647, 61st Cong., 2d sess.
Sept. 22, 1922	Channel across the shoal southeast of Yerba Buena Island, and thence to Webster St.; south channel in Brooklyn Basin; turning basin at east end of Brooklyn Basin; and the channel in the tidal canal from Brooklyn Basin to Park St.	H. Doc. 144, 67th Cong., 2d sess.
Jan. 21, 1927	Channel from Webster St. to Brooklyn Basin, the maintenance of the area to within 75 feet of the pierhead line south of the channel from Harrison St. to harbor line point 119 in Brooklyn Basin; dredging of a triangular strip about 2,700 feet long and maximum width of 300 feet and deepening to 25 feet of the tidal canal above Park St. to San Leandro Bay.	H. Doc. 407, 69th Cong., 1st sess.
Apr. 28, 1928	Local cooperation requirements modified to provide that alteration or replacement of bridges by local interests shall apply only to that feature of the project covering the deepening of the tidal canal to 25 feet. The draw bridges across the tidal canal were required by the decree of the court in condemnation proceedings whereby title was obtained to the right of way for the tidal canal.	Public Res. 28, 70th Cong.
July 3, 1930	Entrance channel to the outer harbor, 800 to 600 feet wide.	Rivers and Harbors Committee, H. Doc. 43, 71st Cong., 2d sess.
Mar. 2, 1945	Elimination of requirement that local interests contribute 10 cents per cubic yard toward deepening the tidal canal.	H. Doc. 466, 77th Cong., 1st sess.
Do . . .	Deepening channel to outer harbor to 35 feet and maintenance of channel and turning basin in outer harbor.	Report on file in Office, Chief of Engineers

During the decade of the 1940s, millions of tons of goods and millions of passengers moved through Oakland Harbor. By 1950, the facility was beginning to rival the Port of San Francisco. It wouldn't be many years before the commerce at Oakland would catch and surpass that of San Francisco. Following is a table summarizing the commerce of Oakland for the period 1940-1949.

Year	Vessel Traffic (tons)	Passengers	Car Ferry (tons)	General Ferry (tons)
1940	3,010,135	2,278,275	847,223	110,005
1941	3,111,184	1,182,962	1,020,978	1,796
1942	4,198,668	1,528,615	1,482,976	2,030
1943	5,258,862	2,455,080	1,607,935	1,742
1944	5,728,638	3,071,836	1,896,338	1,345
1945	6,147,209	3,206,228	2,218,577	1,252
1946	4,976,334	2,298,909	1,422,218	751
1947	2,788,489	1,716,248	1,667,207	838
1948	3,154,048	1,657,811	1,371,126	816
1949	3,415,334	1,351,518	1,101,424	829

It will be remembered that the first formal modification to the original Oakland Harbor Project of 1874 was made in 1901. Over the half-century that followed, the project was altered to meet the new demands of larger ships and increased traffic. Channels were widened, deepened and lengthened to satisfy the changing requirements of peace time trade and the demands of two world wars. Few other harbors reflect the growth experienced by Oakland during the first half of the twentieth century.

Richmond

Some 10 miles northwest of Oakland is the city and the deep water port of Richmond. The city, incorporated in 1905, forms the northern anchor point for the chain of communities that range along the "contra costa"—the east shore of San Francisco Bay. Generally, the city and port are considered simply as just another of the nondescript industrial complexes that serve the bay area. On the whole, this is unfair. Over the years, the city and port facility have contributed significantly to the economical well-being of the region. Richmond, in fact, in terms of tons of material handled, is one of the chief ports of North America. Much of the prosperity of the port, and hence its ability to positively influence its neighborhood, can be traced to the San Francisco District Corps of Engineers.

The Richmond district was first traversed by Europeans when Pedro Fages and Padre Crespi in company with a small exploring party came to the area in 1772. Some, in fact, hold that it was this group that first saw the Golden Gate.

The first American to settle the area around Richmond was John Nicholl, who purchased 200 acres of the Rancho San Pablo in 1857. Not long thereafter, Jacob M. Tewksbury, surgeon and landgrabber, acquired a considerable tract extending from Point San Pablo to Point Richmond.

In 1870 the greater part of the present waterfront and industrial belt, known as the Potrero (pasture) District was separated from the mainland by a slough. Left as an island, it would have been declared federal property, as were all the islands in San Francisco Bay in 1866. By building a dam across the southern end of the slough, Dr. Tewksbury caused shoaling and ultimately the closing of the waterway, until then deep enough to accommodate a variety of small craft. The federal government, in 1872, declared the tract a peninsula, and thus defined as such was considered a part of the old Rancho San Pablo, and thereby belonged to Tewksbury.

Five years later, when the Central Pacific Railroad entered the area, it by-passed Richmond and built a station called Stege, two miles southeast of the town. But the Santa Fe Railroad, in 1899, selected Richmond as its western terminus, and this proved to be the catalyst for industrial development.

Oil became the dominant cargo to move through Richmond. A China-bound steamer started the oil trade in 1894. Then, in 1902, the Standard Oil Company built the first unit of its great refinery in Richmond. At about the same time, ferry service linked the emerging industrial city with San Francisco. With a direct link by rail to the

The castle-like facility of the California Wine Association was but one of the large plants that boosted the economy of Richmond.

interior, and an over-water connection to San Francisco (with its availability to world trade), Richmond was pushing hard for a sizeable piece of the commercial action centering on the Bay Area.

With Oakland as a model, Richmond began approaching the San Francisco District Corps of Engineers for assistance relative to harbor development. For their part, however, the Engineers were desperately trying to bring order to the "contra costa," in terms of harbor facilities and overall growth patterns. It will be remembered that Colonel Thomas H. Reese was studying the entire East Bay region with an eye toward comprehensive development. According to his view, Richmond would be on the northern end of the deep water channel that was to run from Oakland, all the way to Point Richmond.

The industrial leadership and commercial interest of Richmond decided to press on, however, and for the moment at least, disregard the Corps' plan for development. Before long, they had put out wharves at Point Orient, thereby linking the port directly with the rest of the world. In 1912, private interests, in cooperation with the city government, began dredging the harbor, thus ensuring for the port a larger share of the available maritime trade.

Even as the private concerns initiated harbor development at Richmond, they maintained a continuing dialogue with the San Francisco District. The Engineers responded by studying the situation, and finally agreed to participate if local interests would pay for one-half the cost of the work, and if the city would construct all bulkheads necessary to retain the dredged materials.

These are storage buildings and tanks of the California Wine Association's plant at Point Richmond. Both photographs are part of a multi-photograph panoramic view of the harbor area.

The River and Harbor Act of August 8, 1917, approved a channel 24 feet deep and 600 feet wide in the inner harbor and the construction of a training wall faced with riprap to protect the channel; a suitable turning basin at Point Potrero; and a channel from the point to Ellis Slough, all to a 24-foot depth at mean lower low water. But due to a delay by the local interests in meeting the conditions prior to commencement of work, the project was held up. Even so, a contract was let with the American Dredging Company for work to begin in July, 1918. The company was to receive 9.83 cents per cubic yard of material removed.

Negotiations continued between the San Francisco District and the harbor interests at Richmond until the details of the project were finally ironed out. Work was begun in 1918, and by the summer of the following year, a channel 200 feet wide, and 24 feet deep from the entrance to Ellis Slough had been completed. Almost two million yards of material had been removed, resulting in a channel just short of three miles in length. By 1920, the city had contributed $100,000 of the $196,000 expended on the project to that time. It is interesting to note as well that more than 36,000 tons of cargo, valued at almost six million dollars, moved through the port that year.

Richmond Harbor work – September 1922. Looking west from Brooks Island, photograph shows fill, pipe line on dike and part of pontoon line. Fill is placed over sheet pile dike to form training wall for the harbor.

By 1926, the work was about half finished. The partially completed Corps' sponsored improvement made the inner harbor accessible to ocean vessels of deep draft, affording the port opportunities for steady, continual growth. Tonnage for the year 1925 was 256,272 short tons exclusive of ferry traffic and commerce in Richmond Outer Harbor, and was valued at over twelve million dollars. And, in addition to the booming maritime trade moving over the wharves and rails at Richmond, ferries brought 420,000 people to and from the city.

Within the brief span of two dozen years, the city had put up a large concrete-pile wharf and private interests had constructed four of

Richmond Harbor – September 1922. Discharge end of pipe is about 200 feet from shore.

Richmond Harbor – November 1922. View of training wall and sheet pile dike taken from Brooks Island, looking west. The Corps of Engineers survey boat Suisun *is seen at top left.*

Richmond Harbor – April 1923. The Corps of Engineers' power shovel works in the quarry near the harbor to secure rock material for the training wall.

Brooks Island Training Wall, Richmond Harbor – April, 1923. A workman is seen on his hands and knees amongst a variety of materials littering the construction site.

ordinary pile, which provided ships some 545 feet of berthing space. Moreover, during 1925-26, private companies and the city were putting the finishing touches on two additional facilities that, when completed, would nearly double the available space for ships. Outside the harbor, but within the city limits, there were eleven wharves and four ferry slips. Most of the above enjoyed rail connections and covered storage areas.

The original Corps of Engineers project was modified in 1930, 1935, 1938, and again in 1945. By the latter date, the project, as modified, provided for a channel 30 feet deep from San Francisco Bay to Ellis Slough (now dignified by the name of Santa Fe Channel), 400 feet wide between the bay and the basin at Terminal No. 1 (near Point Richmond); then 500 feet wide to Point Potrero, with an increased width, 1,150 feet at the turn off at that point; then widening from 700 feet just east of Point Potrero to 850 feet; then 850 feet wide to the Santa Fe Channel; for widening and flaring to the basin at Terminal No. 1 and the subsequent maintenance, to a depth of 30 feet, of the basin as thus enlarged to 75 feet of the pierhead line; for the maintenance to a depth of 30 feet in the Santa Fe Channel to within 50 feet of the established harbor lines; for approach areas 32 feet deep to within 75 feet of the pierhead line in the outer harbor at Point San Pablo, Point Orient, and Richmond Long Wharf; for a channel 20 feet deep, 150 feet wide and some 2,000 feet long from deep water in San Pablo Bay easterly along the north side of Point San Pablo; and for a training wall 10,000 feet long extending in a general westerly direction from Brooks Island. All depths refer to mean lower low water.

The Act of 1938, not only modified the physical features of the Corps' project, but changed requirements relative to local cooperation. From that time on, local interests had to furnish necessary rights-of-way and spoil-disposal areas for initial work and subsequent maintenance work. Moreover, no portion of the channel widening north of Point Potrero, authorized by the 1938 Act, could be

The training wall as it appeared in January, 1924. In the background an ocean going cargo vessel can be seen making ready to get under way. Beyond the large ship is the ferry slip.

undertaken until assurances were received that industries would indeed avail themselves of the improved navigation facilities.

While the advent of World War II would mean dramatic changes for the cultural, social and economic life of Richmond, the pre-war years witnessed steady, continuing growth of the port and its attendant facilities. By 1940, the world's largest oil refineries were situated here. In addition, Richmond had become the clearing house for one-eighth of the world's supply of gasoline and petroleum products. The four major terminals along the Richmond waterfront were handling in 1940 an annual cargo of nine million tons, with oil remaining the principal commodity. Sixty major industries, including fish reduction plants, chemical works, an asphalt products plant, and tile, brick, enamel and pottery works, were now parts of the industrial complex.

World War II changed every village and city in the nation, but few underwent the dramatic alteration experienced by the port and city of Richmond. All of the patterns of growth that had been exhibited in the 1920's and 1930's were bloated almost beyond recognition by the pressures of war — especially the pressures applied by the injection of $35 billion of federal money into California between 1940 and 1946.

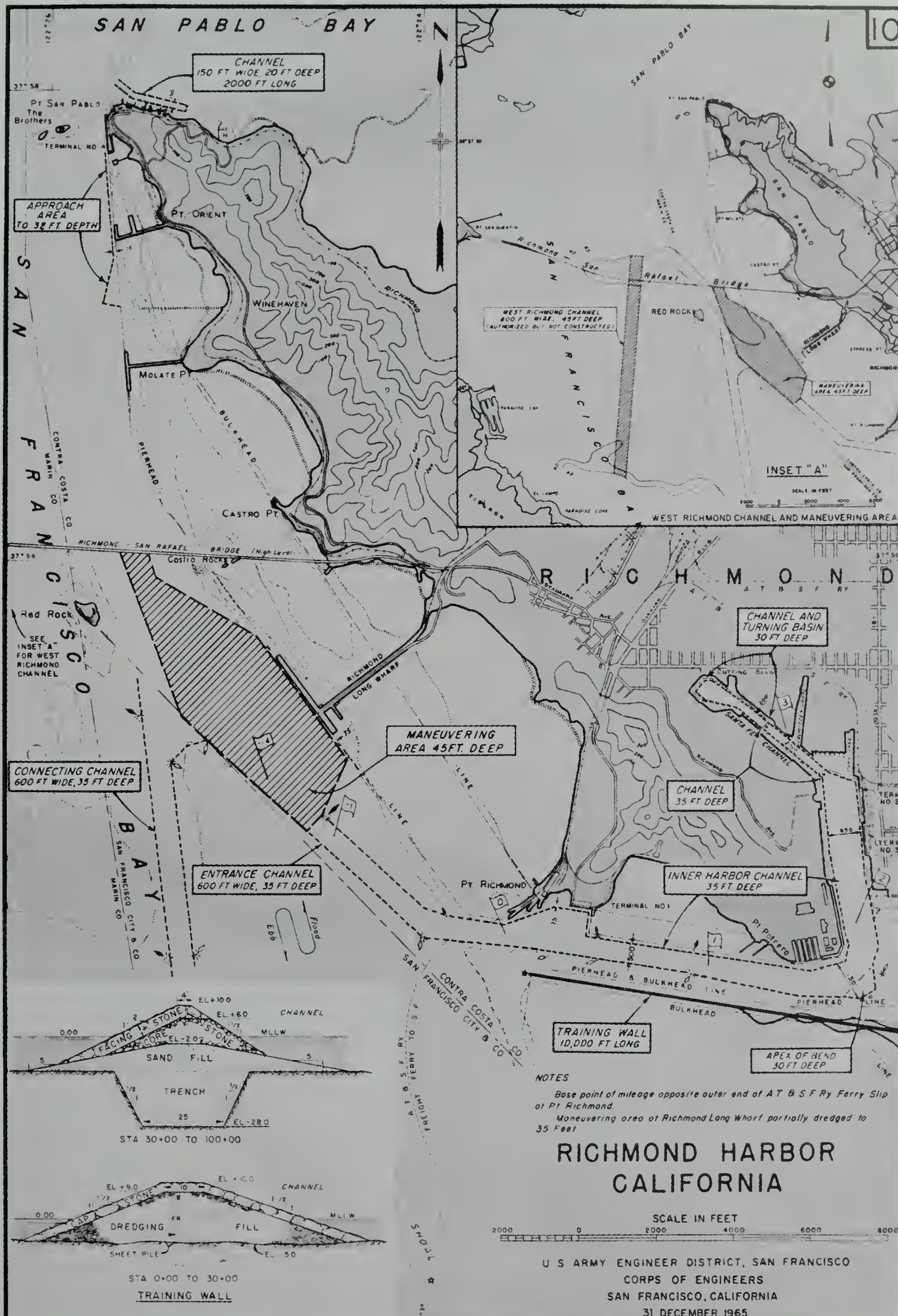
One of the first industries to be affected was that of ship building. While all of San Francisco District's harbor cities underwent change — Eureka on Humboldt Bay, San Francisco, Sausalito, Vallejo (and Mare Island), Oakland and Alameda — Richmond was truly metamorphosed. Most of the three billion dollars invested in California for ship construction went to the San Francisco Bay Area, and most of the Bay Area's share went to the Richmond shipyards of the Permanente Metals Corporation, a subsidiary of the imposing conglomerate then being erected by Henry J. Kaiser. Seagoing tugs, tankers, amphibious landing craft, PT boats, freighters and Victory ships slid off the ways, and into channels created by the San Francisco District Corps of Engineers, in astonishing numbers. No statistics, however, could match those of the cargo-carrying Liberty ships that

provided the war effort with its most efficient line of supply. Of the 2,158 liberty ships constructed between the summer of 1941 and the summer of 1944, 53 percent were built in the yards of the Pacific Coast, and 23 percent were built in Kaiser's Richmond yards, which employed more than 100,000 workers.

Kaiser's reputation for engineering and industrial ability was initiated with the construction of Hoover and Parker Dams, and continued to grow with his major role in the building of the San Francisco-Oakland Bay Bridge, and the great dams of the Pacific Northwest at Bonneville and Grand Coulee. In order to produce cement in quantities to meet his demands, Kaiser had built Permanente, the world's largest cement plant. Even before the United States' entry into the second world war, he had predicted wartime industrial needs, and had projected the first steel mill on the Pacific Coast, 50 miles east of Los Angeles at Fontana, a small hog-raising community on the windswept plain near San Bernardino.

The first Liberty ship required 244 days for completion and delivery. By the summer of 1943, that time had been reduced to an average of 50 days per ship. But in full operation for 24 hours a day in three shifts, Liberty ships were soon being put together in 25 days. By 1943, a new cargo carrier was launched every 10 days at one or another of the Kaiser shipyards. One ship, the *Robert E. Perry,* was completed in eight days, a record that stands to this day. The concentration of men, material and energy required for such production was enormous. The effect of the concentration, though necessary, was a mixed blessing for the Bay Area and especially for the port and city of Richmond. But, whatever the case, the San Francisco District's harbor improvements provided Richmond (and Kaiser) the opportunity to make truly substantial contributions to our war effort.

Richmond Harbor – August 1924. A portion of the training wall can be seen with its new covering of rock. A derrick barge and a barge load of rock is tethered alongside. Note the stillness of the water in the harbor.


10
SAN PABLO BAY
CHANNEL 150 FT WIDE, 20 FT DEEP 2000 FT LONG
Pt San Pablo
The Brothers
TERMINAL NO 4
APPROACH AREA TO 32 FT. DEPTH
Pt. Orient
Winehaven
Molate Pt
Castro Pt.
Castro Rock
Red Rock
RICHMOND - SAN RAFAEL BRIDGE (High Level)
SEE INSET "A" FOR WEST RICHMOND CHANNEL
SAN FRANCISCO BAY
CONNECTING CHANNEL 600 FT WIDE, 35 FT DEEP
MANEUVERING AREA 45 FT. DEEP
ENTRANCE CHANNEL 600 FT WIDE, 35 FT DEEP
RICHMOND LONG WHARF
PIERHEAD
BULKHEAD
LINE
R I C H M O N D
A T & S F RY
CHANNEL AND TURNING BASIN 30 FT DEEP
SANTA FE CHANNEL
CHANNEL 35 FT DEEP
INNER HARBOR CHANNEL 35 FT DEEP
Pt Richmond
TERMINAL NO 1
Pt Potrero
TERM NO 2
TERM NO 3
PIERHEAD & BULKHEAD LINE
TRAINING WALL 10,000 FT LONG
APEX OF BEND 30 FT DEEP
SAN FRANCISCO CITY & CO
CONTRA COSTA CO
MARIN CO
A T & S F RY FREIGHT FERRY TO S F
Ebb
Flood
SHOALS
WEST RICHMOND CHANNEL 600 FT WIDE, 45 FT DEEP (AUTHORIZED BUT NOT CONSTRUCTED)
RED ROCK
MANEUVERING AREA 45 FT DEEP
INSET "A"
WEST RICHMOND CHANNEL AND MANEUVERING AREA
EL +10.0
EL +6.0
FACING STONE
CORE
EL -2.0
MLLW
SAND FILL
TRENCH
EL -28.0
STA 30+00 TO 100+00
EL +9.0
EL +10.0
DREDGING FILL
SHEET PILE
EL -5.0
STA 0+00 TO 30+00
TRAINING WALL
CHANNEL
NOTES
Base point of mileage opposite outer end of A T & S F Ry Ferry Slip at Pt Richmond.
Maneuvering area at Richmond Long Wharf partially dredged to 35 Feet
RICHMOND HARBOR CALIFORNIA
SCALE IN FEET
2000 0 2000 4000 6000 8000
U S ARMY ENGINEER DISTRICT, SAN FRANCISCO
CORPS OF ENGINEERS
SAN FRANCISCO, CALIFORNIA
31 DECEMBER 1965

Following the war, California, the Bay Area, and Richmond continued to expand in almost every respect as the postwar economics boom got under way. The major work done by the San Francisco District from the end of the war to mid-century was the dredging of the channel into San Pablo Bay, allowing the ever-increasing maritime trade easier access to Richmond port facilities. By that time, the project was considered 94 percent complete; the only work remaining to be done was the widening of the channel north of Point Potrero. The work was postponed, in part at least because local interests had not complied with all of the requirements set forth in the authorization.

The mid-channel controlling depths over the various project channels in the inner harbor at the times indicated were as follows: Channel from deep water in San Francisco Bay to west side of turning basin at Terminal No. 1, 27 feet; turning basin No.1 to Point Potrero, 28 feet; from Point Potrero to Santa Fe Channel, 28 feet, all as of April, 1950; Santa Fe Channel, 27 feet, as of May, 1948. Approach area at Point San Pablo, 25 feet; approach area at Point Orient, 30 feet in December, 1948. Channel east of Point San Pablo, 11 feet in August 1949.

The costs and expenditures of the Corps of Engineers' work at Richmond to the end of Fiscal Year 1950 were as follows:

	New Work Costs	Maintenance Costs	Total Cost & Expenditures
Regular Funds	$ 709,017.63	$830,329.54	$1,539,347.17
Public Works Funds	105,000.00	—	105,000.00
Contributed Funds	524,777.66	34,800.20	559,577.86
Total	1,338,795.29	865,129.74	2,203,944.07

Richmond Harbor — 1975

By mid-century Richmond harbor was importing and exporting everything from distilled spirits to fertilizers. Oil and petroleum products, however, continued to count for the largest volume of cargo handled. During the period, Richmond Long Wharf was the busiest pier in San Francisco Bay. Some 35 million barrels of petroleum products passed over it inward and 43 million barrels outward annually. In large measure, the development of the port and the city of Richmond, and their respective contributions to the state and nation, can be traced to the harbor-building efforts of the San Francisco District Corps of Engineers. While the District's Engineers had encouragement and assistance from private and public interests centered in Richmond, it was, nonetheless, the Army Engineers from across the bay that provided the vast majority of the funds, planning and manpower necessary to turn mud-flats, shallow water and a rough, jagged peninsula into one of the busiest ports in North America.

San Pablo Bay

Adjacent to Richmond is the channel project cut through San Pablo Bay that extends into Mare Island Strait. It will be recalled that San Pablo Bay is the main northerly arm of the San Francisco Bay system, and that Mare Island Strait, the estuary of the Napa River, provides access to Mare Island Naval Shipyard and commercial and recreational docking facilities in the City of Vallejo. Moreover, the channel in San Pablo Bay carries commerce enroute to Mare Island Strait, the Napa River, Carquinez Strait, Suisun Bay, and ports on the Sacramento and San Joaquin Rivers. In addition to its uses for commercial and military purposes, the waterway has, over the years, seen a growing number of recreational craft.

Vallejo/Mare Island – 1906. A single-ender ferry prepares to unload a group of passengers at the Monticello Company's wharf. Vallejo was a busy port during the early 1900s.

British grain ships wait in the Carquinez Strait until they can tie up at the Port Costa docks to take on wheat. The photograph, taken in 1902, twenty years past the peak of the trade, demonstrates that square riggers still played a role in Bay Area life.

From the time of the Gold Rush era, this waterway has been an important link in the water courses of the bay, and a vital passageway for waterborne traffic to and from California's Great Central Valley. As was cited earlier, the San Francisco District first submitted preliminary examination reports for improving this channel just prior to the turn of the century, and actually undertook improvements in 1902.

Over the next 50 years, a pair of world wars, unfettered economic expansion and phenomenal growth in population dictated that improvements be made throughout the Bay Area in terms of maritime facilities. The San Pablo and Mare Island Strait (Pinole Shoal) Channel was an important part of these improvements.

Initially, the project authorized a five-mile-long channel having a width of 300 feet. This work was completed within a relatively short period of time, but soon began to deteriorate. Early in 1911, a hydrographic survey conducted by the San Francisco District revealed that the channel had been completely obliterated. Subsequently, specifications were prepared under the 1911 River and Harbor Act providing for dredging a new channel through Pinole Shoal 500 feet wide and 30 feet deep at an estimated first cost of $510,000. The new proposal also called for a government dredge to be constructed at a cost of $250,000, and an additional $100,000 be earmarked for annual maintenance.

On November 9, 1911, the San Francisco Bridge Company began dredging operations to obtain a channel 27,200 feet long, 500 feet wide, and 30 feet deep through Pinole Shoal, for a contract price of 18-7/8 cents per cubic yard. By June of 1912, the work was considered to be about 17 percent complete. Just three years later, in June, 1915, the dredging part of the project was completed.

It will be remembered that the prosecution of work on San Pablo Channel hadn't always gone smoothly, As was recorded earlier,

the original contractor of 1902 had defaulted on his contract and forfeited all payments due him. In 1914, the executrix of the estate of the deceased contractor filed suit in the Court of Claims for a remission of this forfeiture, but the suit was dismissed on the plea of the statute of limitations. Later, the remission of the forfeiture was allowed by the auditor for the War Department and the money necessary for payment was appropriated by the Deficiency Act of March 4, 1915, and paid to the claimant.

The next year, the San Francisco District, under the direction of Colonel Thomas J. Rees (he also served as Division Engineer) carried out surveys across Pinole Shoal to determine the extent of shoaling. Meanwhile, the seagoing dredge, *San Pablo,* was completed at Baltimore, Maryland on June 26, 1916, and sailed via the Panama Canal to the San Francisco District. The dredge arrived in August, and was put to work immediately, redredging the channel across the shoal. Except for a brief period spent dredging in Mare Island Strait, the *San Pablo* worked throughout the year on the Pinole Shoal area, excavating 1,777,727 cubic yards of material. She then went into drydock for repairs and overhauling.

A survey of the dredged area revealed that a total of 3,227,000 cubic yards had been removed from the channel and side slopes during the year, which meant that almost a million and a half yards had been stirred up by the dredge and carried away by the bay's currents. Expenditures at the end of Fiscal Year 1917, totaled $865,432.77, including $81,813.59 for maintenance. Tonnage for the calendar year 1916 was 4,122,000 tons valued at over 84 million dollars.

It should be mentioned at this time that the shipyard at Mare Island was, and is, a major construction and repair facility for the U.S. Navy on the Pacific Coast. Hence, national defense needs demand that adequate channels be maintained to and from the facility.

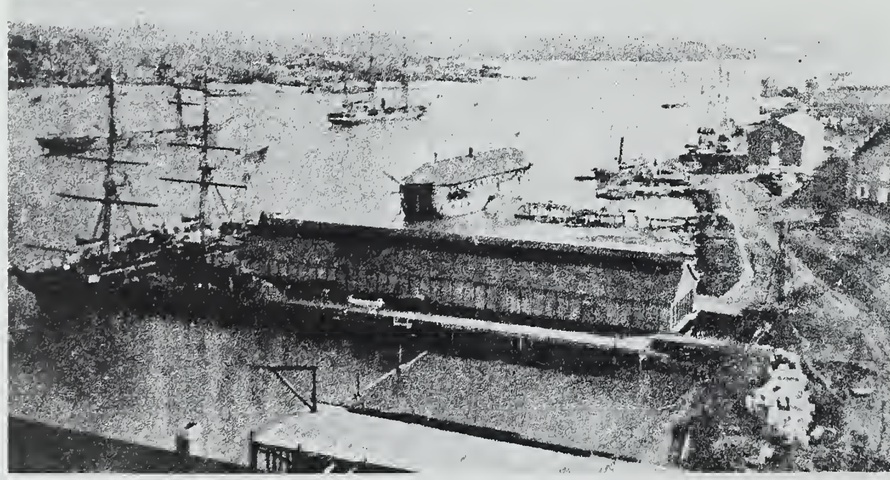
The island was first named "Isla Plana" (meaning plain or flat island in Spanish) in 1775 by Juan Manual de Ayala of the *San Carlos.* The legend of its present name is connected with General Vallejo. Popular belief has it that one day a barge carrying horses and cattle across the Carquinez Strait was caught in a sudden squall. The craft capsized resulting in the loss of some of the livestock. A few of the horses, at least a white mare belonging to the General's wife, in particular, swam to the island, where she was rescued a few days later. General Vallejo, the story goes, was so happy to have the mare back, he named the island "La Isla de la Yegua" — Mare Island.

In 1851, Congress authorized a floating drydock for the West Coast, and sent a Naval Commission the next year, headed by Commodore John D. Sloat, to the San Francisco Bay area to investigate and recommend a site for a Navy yard and depot. Mare Island was selected and purchased by the federal government for $84,401. The first commandant, Commander David G. Farragut, arrived on September 16, 1854, and immediately began construction of a shipyard. Farragut, it will be remembered, went on to win fame at the battles of Vicksburg and Mobile Bay during the Civil War, and later became the Navy's first full admiral.

Mare Island Navy Yard was established in 1854. This view, sketched in 1855, looks westward from Vallejo across the Napa River (Mare Island Strait) to the yard and beyond to San Pablo Bay. In the far left of the picture can be seen the newly-completed floating dry-dock, built in New York and shipped in sections around the Horn.

Mare Island covers some 2,700 acres, and in addition to the shipyard, has an ammunition depot, marine barracks, Navy West Coast radio transmitting station, nuclear power school, and a naval missile school.

The floating drydock, authorized by Congress in 1851, was built in New York, shipped around the Horn in sections, and placed in service at Mare Island in 1855. Since that time, the naval shipyard has repaired thousands of ships, and has built over 500 craft for the Navy, including the battleship *California.* Here also was built the first warship constructed on the coast *(Saginaw,* 1859); the first conversion of a Navy coal burner to oil *(Cheyenne,* 1908); construction of the first flight deck on any ship in the world (cruiser *Pennsylvania,* 1911); and building of the hull of the world's first aircraft carrier *(Langley).* The Navy's oldest chapel, Saint Peter's, dedicated in 1901, stands there. Mare Island's cemetery was established in 1856 and contains 900 graves, including those of sailors of eight nationalities and the daughter of Francis Scott Key, author of our national anthem.



Mare Island Navy Yard – 1870. Looking southeast to Vallejo and the entrance to the Carquinez Strait, two steam sloops-of-war are anchored in mid-stream while a third is moored at the wharf in the foreground.

One of the first American submarines in the Pacific was commissioned at Mare Island. This 1904 picture shows the Pike *tied up at the yard during the period of her sea trials.*

By mid-century, Mare Island was the only shipyard, public or private, on the West Coast, equipped to build nuclear-powered submarines. Both fast attack and Polaris-firing atomic submarines have been built there since 1955.

From the above, then, one can see how the San Francisco District, rather early on perceived the growing importance of San Pablo Bay and Mare Island Strait. This sense of importance was heightened when, in April, 1917, the United States declared war on Germany. That same year the River and Harbor Act authorized the deepening of the San Pablo Bay-Mare Island Channel to 35 feet, maintaining a width all the way to the turning basin at Mare Island, and dredging a turning basin of 1,000 feet wide in front of the quay wall.

The Navy, who for its part had been maintaining the Mare Island Channel previously, suggested that no more than a 30-foot deep channel was needed for their purposes. Hence, the sea dredge *San Pablo* continued the redredging project across Pinole Shoal and within Mare Island Channel to the earlier authorized project depth of 30 feet. By the end of 1919, millions of cubic yards of sand and mud had been removed from the channels and more than a million dollars expended for the new work and maintenance. In addition, the Navy spent $298,000 for the construction of a sheet pile dike off the southwest corner of Mare Island for the benefit of the channel. The Corps' improvements not only guaranteed the safe passage of military craft but caused an increase of commerce in this area because, now, deep-draft vessels could land directly at desired locations. The value of non-military cargo had, by 1919, increased to $164 million annually. At the end of Fiscal Year 1922, there was a channel of full project width, with a controlling depth of 29 feet over Pinole Shoal in San Pablo Bay. Apparently the Navy saw the need for more than 30 feet of water near

Mare Island, because, by that same time, the summer of 1922, the San Francisco District's dredge *San Pablo* had removed sand, mud and hard clay from Mare Island Channel to a depth of 35 feet. By the following year, the entire project as authorized by the 1917 River and Harbor Act was about half finished.

Not only did Mare Island build and repair Navy vessels, the facility also did on occasion a bit of work for the Army. Toward the end of 1923, the U.S. seagoing hopper dredge *Culebra* arrived from the Panama Canal and, by late spring the next year, was transferred to the Seattle District. During her brief stay in the Bay Area, however, the *Culebra* did some work on the Pinole Shoal Channel and was converted from a coal to an oil burner at Mare Island.

As a matter of fact, the San Francisco District and the Navy at Mare Island worked well together during the 1920s. Throughout the period, the Navy spent millions of dollars for dikes and other projects that had a direct bearing on channel development and maintenance. On the other hand, the Corps of Engineers, through the San Francisco District, had spent more than two million dollars to ensure the safe passage of all but the very deepest draft naval vessels.

The 1917 project was, by the summer of 1926, about 75 percent complete. Moreover, the value the maritime trade (tonnage) had by that time reached a value in excess of $209 million annually. Improvements made by the Corps meant that shipping points on San Pablo Bay, Carquinez Strait and Mare Island Strait were now accessible for commercial deep-draft ocean vessels. Moreover, by the mid-1920's, more than 800,000 persons were arriving and departing annually by ferries serving the northbay region — Vallejo, across the channel from Mare Island, being the longest ferry ride in the Bay Area from San Francisco. To handle the hundreds of thousands of people and millions of tons of cargo, service and landing facilities were necessarily expanded. There were three wharves along the southern shore of San Pablo Bay, two along the northern shore, seventeen along the southern shore of Carquinez Strait, and four on the northern shore of the strait, practically all of which were privately owned. The largest of these had warehouse storage facilities and connections with major railroads and highways. On Mare Island Strait Channel, facilities on the western or Navy yard shore included a long quay wall and numerous piers and wharves belonging to the Navy Department. Across the strait on the Vallejo shore were nine wharves, one of which belonged to the City of Vallejo. Six had storage facilities, four had rail terminal facilities, three were provided with oil pipe lines and two with water pipelines.

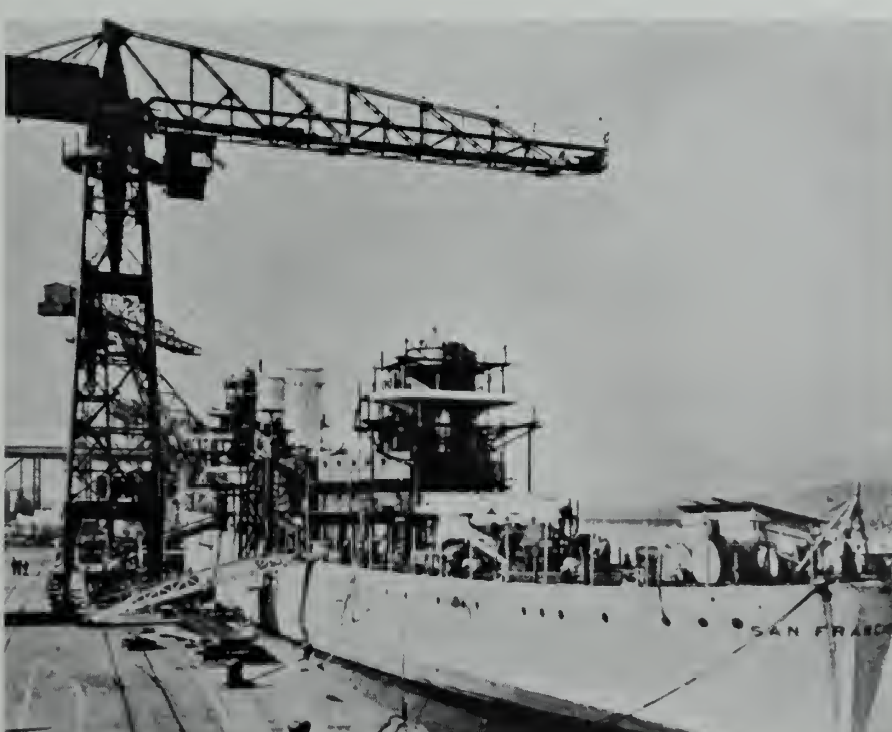
District Engineer 1935-1939
Lt. Col. James A. Dorst

The 1917 project was, for all intents and purposes, completed by 1927, at which time, because of a reevaluation of needs, the project was modified. The River and Harbor Act of January 21, 1927, authorized the 35-foot channel across Pinole Shoal to be widened to 600 feet. Within Mare Island Strait, the project as modified called for expanding the channel to a width of 600 feet but, curiously, of reducing the depth from 35 to 30 feet. Apparently the new, larger ships operating in the water course that separated Vallejo from Mare Island required a wider

path, but not, for the moment at least, a deeper one. Whatever the situation, the new project was completed by the summer of 1929 at a saving of over a half million dollars from anticipated costs.

The stock market crash of 1929 and the depression which followed was felt in the Bay Area as it was elsewhere in the nation. And, as money became less available, people purchased fewer commodities, which meant that there was less demand for commercial shipping. Statistics gathered by the Corps of Engineers for this period reflect a general decline in the amount of goods shipped in the Bay Area. By the summer of 1936, tonnage for the San Pablo Bay - Mare Island Strait area had fallen to approximately two million tons, with a value of $50,000,000. Fewer people were riding the ferries to and from north bay ports as well. This can be accounted for partly because of the depressed economic conditions of the time and the fact that Carquinez Strait had been spanned by an enormous cantilever-type bridge in 1927. Finally, the the autumn of 1937, when only an average of 40 passengers a day were using the ferry to the north bay region, general ferry service was discontinued.

But as the world-wide political condition deteriorated, and the United States began gearing up for the potential of war, both private and governmental maritime activity began to increase. More than that, Mare Island, following the end of World War I, began building very large warships which required considerable maneuvering room. Classic examples were the battleship *California,* completed in 1921, and the 10,000 ton heavy cruiser, *San Francisco,* launched in March, 1933. Such being the case, the project was again modified in 1938, which authorized the width of Mare Island Channel to be increased to 700 feet, and increasing the length of the adjacent turning basin.



The San Francisco *was launched at Mare Island early in the spring of 1933. She returned to the yard for extensive repairs after seeing action in the Battle of Guadalcanal.*

On November 7, 1940, just a year and a month prior to the attack on Pearl Harbor, the Chief of Engineers, upon the recommendation of Lieutenant Colonel K. M. Moore, San Francisco District Engineer, suggested the existing project, then 82 percent completed, be modified to provide two approach areas 20 feet deep to within 50 feet of the pierhead line adjacent to the waterfront at Vallejo and South Vallejo. This proposal was formalized and authorized by the River and Harbor Act of March 2, 1945.

In the meantime, the San Francisco District remained very active in the area, maintaining the channels in San Pablo Bay and Mare Island Strait to accommodate the tremendous amount of wartime traffic.

Following the war, area facilities were busy repairing and dismantling a great variety of warships, assuming a significant role in the expanding manufacturing and marketing industries, and generally returning to the ups and downs of a peace-time economy. Over the years too, the United States hopper dredges *Mackenzie* and *Davison* took over the yeoman duties of the old *San Pablo,* by working intermittently in Mare Island Strait and the Pinole Shoal area, removing millions of cubic feet of material to maintain safe depths in the channels. By 1950, the project was considered 97 percent complete. The total cost of the half-century of Corps of Engineer work amounted to $3,120,210.89.

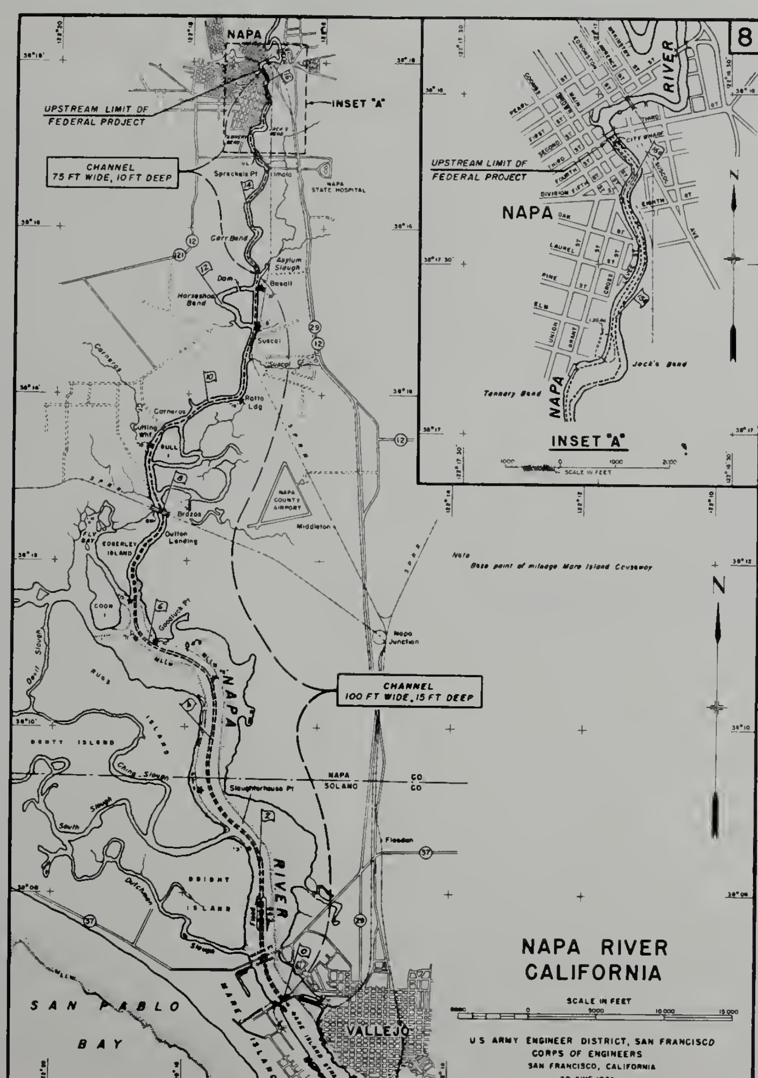
Even while the San Francisco District labored on the "contra costa" with major harbor and related navigation projects, it remained cognizant of the needs of the smaller communities and ports of call around the bay. Though the growth in these hamlets wasn't as explosive as witnessed on the "contra costa," it was nonetheless steady and important, not only in terms of the individual regions, but when viewed in the composite, vital to the social and economic well-being of the entire Bay Area.

Moving from Mare Island in an arc to the north, west and then south, one comes upon the towns and port facilities of Napa, Petaluma, San Rafael and Redwood City. As was recorded earlier, each, with the exception of San Rafael, had been improved by the San Francisco District prior to the turn of the twentieth century. And in terms of definition, each is actually a tidal estuary, at least in the navigable portions.

The Corps of Engineers' dredge "Davison" *leaves its berth in Sausalito to keep shipping channels clear in the vast San Francisco Bay. Note suction heads at side which let down to suck up sedimentation in ship lanes.*

Napa River

The original project for the Napa River was adopted in 1888. This was subsequently modified in 1919, 1935, and 1945. In each case, the channel was both deepened, widened, and straightened so as to permit larger vessels to utilize the waterway. Over the years, the farm products and passengers carried on the stream in the early days gave way to bulk cargoes such as petroleum products and sand and gravel. In fact, the extraction of the latter from the river actually helped maintain project depths. The amount and value of the goods shipped showed an upward curve generally from after the first world war all the way through the period of the second world-wide conflict. Following World War II, however, the tons per year shipped to and from Napa declined steadily, until in 1949, the tonnage was that of pre-World War I days. It's suspected that trucks and the railroad were gaining a larger share of the business.



Petaluma

The situation and pattern of development at Petaluma during this period were similar to that of Napa. The original work began prior to 1900 and was then enlarged in scope by Acts of 1918, 1922, and 1930. With the exception of annual maintenance, the last project was completed in 1933. This provided a channel eight feet deep all the way from San Pablo Bay to the turning basin at Petaluma. In terms of goods shipped, farm products accounted for a considerable part of the total, but as with Napa, petroleum products and the raw materials needed for the production of concrete made up the majority of the annual tonnage. Moreover, the post World War II decline in amounts shipped was reflected in the statistics for Petaluma as well.

Petaluma River at high tide – 1968.

San Rafael

Curiously, just the opposite was true for San Rafael. Here, where the commodities were limited primarily to petroleum products, there was a general decline during the war years, but growth in tonnage after the war. Local interests had appealed to the San Francisco District for harbor improvements since 1890. But it wasn't until 1919 that the small tidal stream was deemed worthy of development with federal funds.

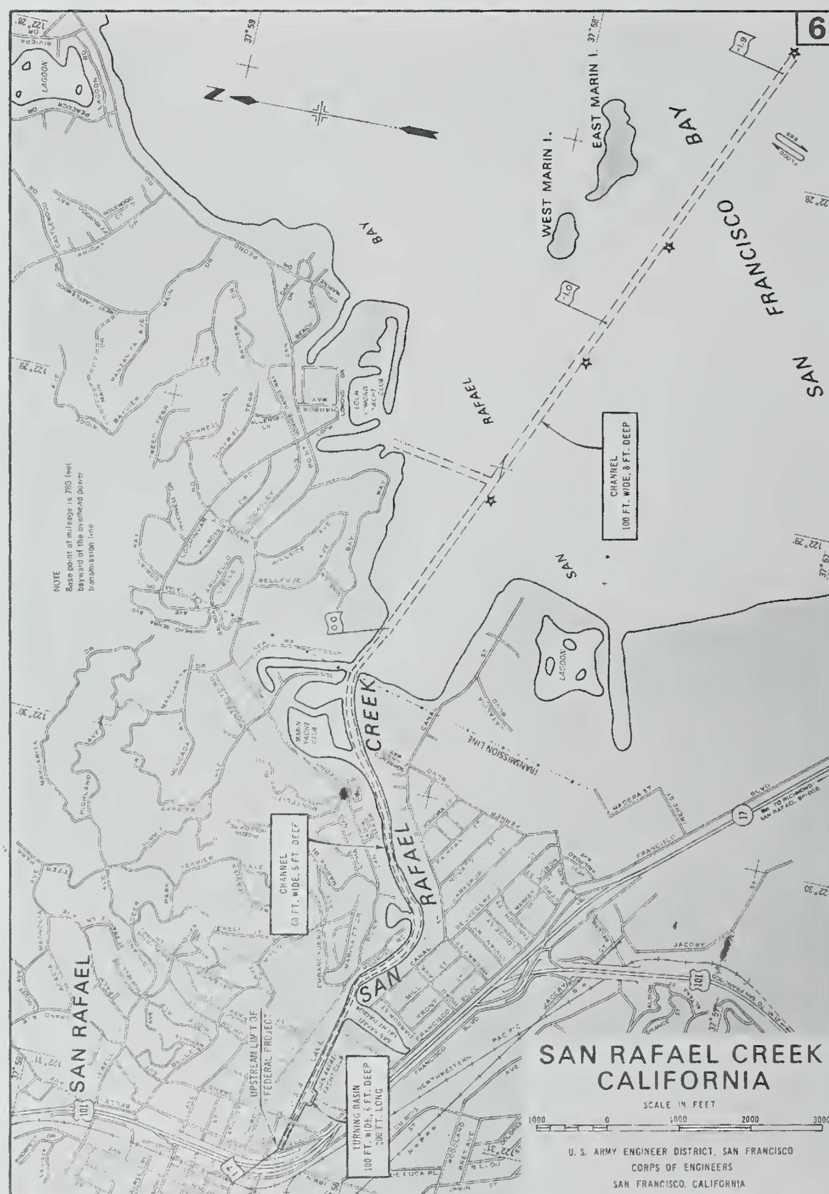
San Rafael Creek is a small estuary about two miles in length flowing easterly and emptying into the west side of San Francisco Bay,

14 miles north of San Francisco. The initial project was completed in March, 1922. This provided a channel four and a half feet deep and 100 feet wide across the mud flats at the mouth of the creek, five feet deep and 60 feet wide through Goose Neck Bend cut-off, four and a half feet deep to San Rafael, with a turning basin near the upper end of the channel 365 feet long, 165 feet wide and five feet deep. The total cost of the work up to the spring of 1922 was $68,000, almost half of which was provided by local interests.

During the 1920s and early 1930s, shipments to and from San Rafael remained rather even, neither falling or gaining in explosive fashion. In these between-the-war years, the cargo was also more varied than it would become after 1940. Hay, fish, animal feeds, molasses, syrup, sugar and cement products made up a significant part of the general merchandise crossing the wharves. The Great

Dredging San Rafael Creek – 1937

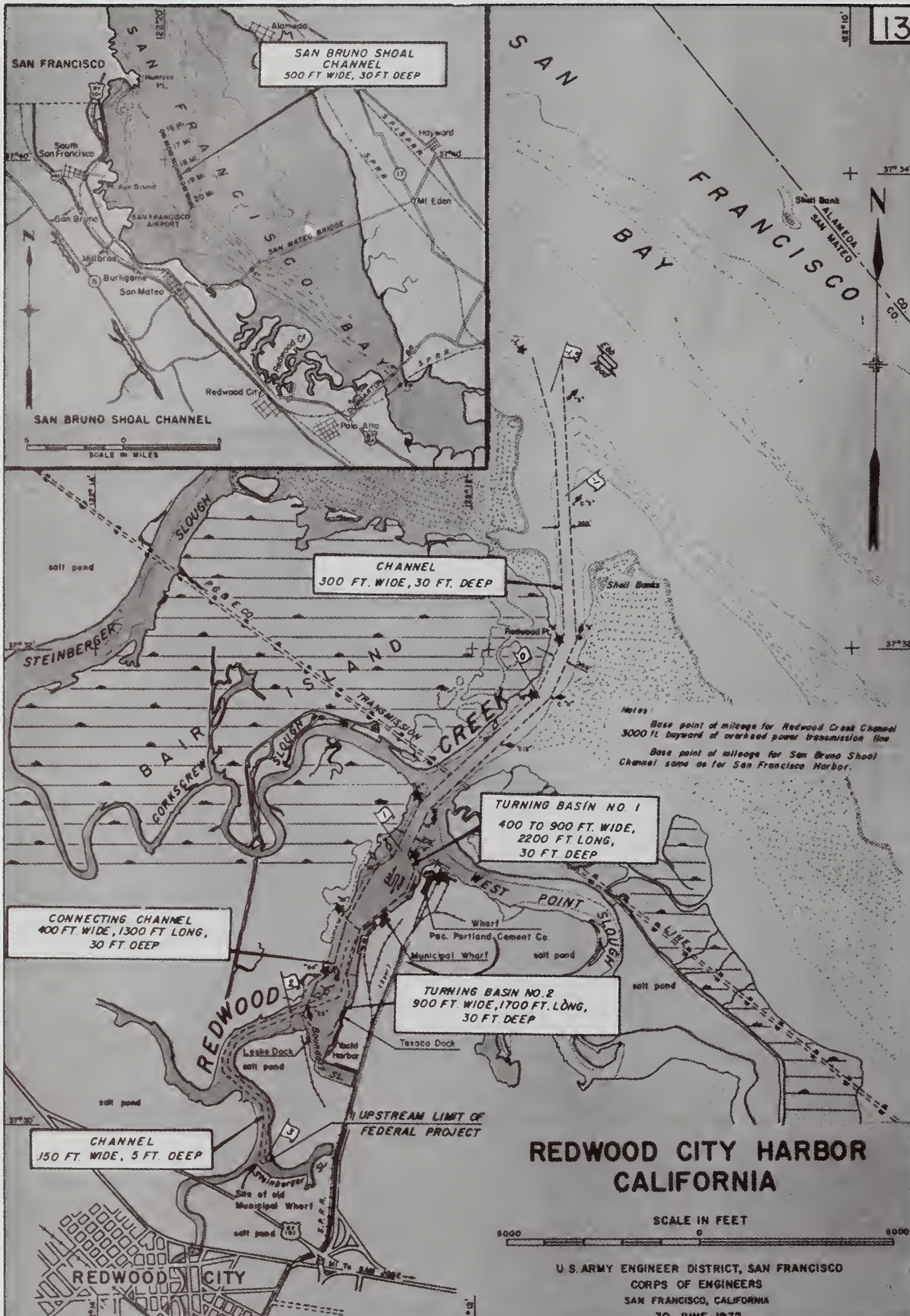
Fourth Street, San Rafael, just after the turn of the century. The San Francisco District completed a small navigation project on San Rafael Creek to improve shipping to and from the town. The initial work was completed in 1922.



Depression, however, had a telling effect on this small port, just as it did on all the others of the Bay Area. In fact, by 1932 there was a decline in the value of practically all items shipped.

During the late 1920s, the San Rafael project was modified slightly to allow for the removal of rocks in the channel at the mouth of the creek to a depth of 10 feet. Then, during the summer of 1932, the entire channel was redredged to authorized project depths. This was considered a maintenance operation and not new work, which would, in essence, be the mode of operation until after 1950. The cost of the San Francisco District work at San Rafael, from the end of World War I to the outbreak of the Korean conflict, amounted to approximately $300,000. In addition, local interests had contributed more than $40,000 to improve the harbor.

San Rafael Creek dredging, with pipe line dredge Sacramento, *and equipment in the channel – August 28, 1937.*


13
REDWOOD CITY HARBOR
CALIFORNIA
SCALE IN FEET
U.S. ARMY ENGINEER DISTRICT, SAN FRANCISCO
CORPS OF ENGINEERS
SAN FRANCISCO, CALIFORNIA
30 JUNE 1972
SAN BRUNO SHOAL CHANNEL
500 FT WIDE, 30 FT DEEP
SAN BRUNO SHOAL CHANNEL
SCALE IN MILES
SAN FRANCISCO BAY
CHANNEL
300 FT. WIDE, 30 FT. DEEP
TURNING BASIN NO. 1
400 TO 900 FT. WIDE,
2200 FT. LONG,
30 FT. DEEP
CONNECTING CHANNEL
400 FT. WIDE, 1300 FT LONG,
30 FT. DEEP
TURNING BASIN NO. 2
900 FT. WIDE, 1700 FT. LONG,
30 FT. DEEP
CHANNEL
150 FT. WIDE, 5 FT. DEEP
UPSTREAM LIMIT OF
FEDERAL PROJECT
Notes:
Base point of mileage for Redwood Creek Channel 3000 ft bayward of overhead power transmission line.
Base point of mileage for San Bruno Shoal Channel same as for San Francisco Harbor.
BAIR ISLAND
REDWOOD CREEK
WEST POINT SLOUGH
STEINBERGER SLOUGH
CORKSCREW SLOUGH
REDWOOD CITY
salt pond
Shell Banks
Redwood Pt.
Wharf
Pac. Portland Cement Co.
Municipal Wharf
Texaco Dock
Leslie Dock
Yacht Harbor
Site of old Municipal Wharf
SAN FRANCISCO
South San Francisco
San Bruno
Millbrae
Burlingame
San Mateo
Redwood City
Palo Alto
Alameda
Hayward
Mt Eden
SAN MATEO BRIDGE
SAN FRANCISCO AIRPORT
ALAMEDA
SAN MATEO

Redwood City

The Redwood City Harbor project (until 1950 known as Redwood Creek) was the recipient of Corps of Engineers attention for the first time in 1884. From that time until the mid-twentieth century, this harbor project was modified and enlarged a half dozen times. Actually a pair of harbors were created since the original work was begun by the San Francisco District. The first was the one dredged near the community of Redwood City. The second, the Port of Redwood City, is located very close to San Francisco Bay itself. The latter is the product of extensive dredging and filling, and is the only one of the four under discussion capable of servicing deep-draft ocean going vessels.

By 1950, the Redwood City Harbor project consisted of the following: a channel 500 feet wide and 30 feet deep across San Bruno Shoal in San Francisco Bay; a channel 300 feet wide and 30 feet deep to the confluence of West Point Slough and Redwood Creek, with a basin at that location 2,200 feet long and from 400 to 900 feet wide; thence a channel 400 feet wide, 30 feet deep, and approximately 1,300 feet long flaring to a second turning basin some 900 feet wide, 1,700 feet long, and 30 feet deep; thence a channel 150 feet deep extending to Steinberger Slough. That was a long way from the original channel 50 feet wide, 3 feet deep and 6,000 feet long, dredged by the San Francisco District.

Just as the harbor had been transformed, the kinds of activities conducted there changed as well.

Once a port for redwood products and tanning supplies, it had, by the time of American entry into World War I, become a place wherein concrete ships were built. World War I witnessed many innovations in shipbuilding. The concrete ship, *Faith,* was one of these. For this type of vessel, no plant or building way is needed for construction, but simply an available space next to water, and a supply of carpenters and masons. The *Faith* was launched sideways at Redwood City on March 14, 1918. To be sure this wasn't the only, nor probably even representative of the general activities of the port, but is illustrative of how diversified trade and manufacturing had become at that time and place. Eventually, the Port of Redwood City became the home of large plants involved with gypsum board, cement and salt. During the decade of the 1940s, cement and gypsum products made up the vast majority of the material handled. For example, during the year 1949, of the total of 1.6 million tons moved, 1.3 million was related to cement and gypsum.

The Faith *is shown at Redwood City Harbor prior to being launched in the spring of 1918. She carried lumber, nitrates and a variety of other cargoes.*

Below are tables outlining the work done by the San Francisco District at Redwood City to 1950, and the costs for same:

Acts	Work Authorized
June 25, 1910	For a 5-foot channel
July 3, 1930	For a 20-foot channel
August 30, 1935	For a 27-foot channel and turning basin at the inner end, 27 feet deep, 1,800 feet long, and 700 feet wide
March 2, 1945	For the channel across San Bruno Shoal and the enlargement and deepening to 30 feet of the channel and turning basin in Redwood Creek
May 17, 1950	Project name changed from Redwood Creek to Redwood City Harbor, California. From the upstream end of the previously authorized project,a channel 30 feet deep, 400 feet wide and about 1,300 feet long to a turning basin 30 feet deep, from 400 to 900 feet wide and 1,700 feet long at the junction of Redwood Creek and Boundary Slough

COSTS

	New Work Costs	Maintenance Costs	Total Costs
Regular Funds	$129,893.03	$415,414.17	$545,307.20
Contributed Funds	119,572.23	—	119,572.23
Total	$249,465.26	$415,414.17	$664,786.61

To gain a clearer idea of the importance of the ports surrounding the bay, from Oakland to Redwood City, excluding San Francisco, one need only compare the volume handled in these secondary facilities with that of the chief port — San Francisco:

	Tons — 1921	Tons — 1929
Port of San Francisco	8,628,000	11,288,778
Rest of San Francisco Bay	6,690,762	30,164,932

The relatively modest facilities at Napa, Petaluma and San Rafael served, in the main, local needs as points of transshipment. On the other hand, Oakland, Richmond, San Pablo Bay and Redwood City harbors were of sufficient size and location to compete successfully for the same kinds of cargoes that had traditionally gone to San Francisco Harbor docks and wharves.

San Francisco

By the time of the Great Depression, the shipping interests at San Francisco became exceedingly alarmed by this trend and began in earnest to study the situation in hopes of reversing the flow of goods from San Francisco Harbor facilities. They found that, even though the completion of the Panama Canal in 1914 was a signal event relative to Pacific Coast commerce, the Canal actually remained a dormant factor for six years in the development of West Coast trade. Not until the world-wide business recessionof 1920-21, with its attendant release of shipping from Europe's pressing demands of war and reconstruction, did the Canal begin to show its real importance. Prodigal ships which had been lured to the Atlantic by lucrative profits now returned to the Pacific in search of cargoes. The resultant competition among the ocean carriers gave to Pacific Coast producers, for the first time, an inexpensive all-water route to the eastern seaboard and to Europe. In addition, Pacific ports began handling increasing amounts of goods destined for the Far East, which had been sent west by rail. Finally, cheap water rates were themselves a stimulus to trade. So, these diversions in world trade currents, with their sudden demand upon existing port facilities, naturally gave an impetus to port development.

San Francisco, in 1921, was as well prepared as any West Coast port to meet the new developments in maritime commerce. Many, in fact, believed that the facilities there were in advance of the immediate requirements. At that time the port enjoyed 35 percent of the total ship tonnage calling on the West Coast. Moreover, terminal charges at San Francisco, from the viewpoint of the shipper or consignee, were as low or lower than anywhere else on the Coast. Even so, San Francisco's trade did not expand as quickly as that of other West Coast ports. More importantly, its share of the total ocean trade of San Francisco Bay declined from a 66 percent share in 1921 to only 32 percent by 1929. And while San Francisco's trade did subsequently increase in both value and volume, Oakland's (and other ports') increased more markedly.

Oakland's rise to prominence as a shipping center occurred especially in the canned and dried fruit trade. (At Richmond it was oil—on the Carquinez Strait, it was grain, sugar and enriched ores.) The fruit industry of Central California expanded significantly during the first world war. And, when after 1921, it sought to send its East Coast and European shipments by the all-water route through the Panama Canal, congestion problems were frequently encountered at San Francisco. Hence, much of its business was turned over to Oakland.

The autumn of 1922 found the port of San Francisco congested rather badly. From time to time, complaints of the conditions appeared in the San Francisco newspapers, until, by 1925, they seemed to have lost their news value. Rate wars, shortages of rail cars, and the tremendous increase in ship tonnage, both in intercoastal and overseas trade only aggravated an already deteriorating situation. Yet

another factor contributing to the congestion problem was the growth in size of vessels, which rendered the design of San Francisco's piers obsolete. Piers once able to berth four ships could, by the mid-1920's, handle but two. San Francisco, being on an already tightly packed peninsula with a finite amount of space to handle and store goods, was at a decided disadvantage when compared to the developing facilities across the bay, where space was of no particular problem. The litany of negative comparisons could be cited at length, but the above should suffice to outline the problems and concerns of shipping interests at San Francisco. Using Oakland as an example, the graph below summarizes the shifting trade pattern.

SHIPPING IN GROSS TONS

Year	San Francisco	Oakland
1921	200,056	105,308
1923	315,211	178,828
1925	284,309	138,758
1926	439,225	231,596
1927	468,575	241,400
1928	481,984	264,458
1929	516,299	360,792
1930	429,956	313,955
1931	410,498	312,463

Even though San Francisco was beginning to lose its position of leadership as the chief harbor on the West Coast, it was, nevertheless, expanding relative to the value and volume of maritime trade. Hence, the dramatic increase in the number (and size) of vessels utilizing the harbor meant that improvements had to be made.

During the early years of the new century, the San Francisco District continued the practice of blowing up underwater rocks in the bay, until by 1916, the worst of this type of obstacle had been removed to a safe level — in some cases, to a depth of 40 feet below the low tide mark. All the while, however, the Engineers continued to monitor the main ship channel, approaching and extending through the Golden Gate. Finally, in 1923, preparations were made to commence dredging the main ship channel through the outer bar, as provided for in the recently adopted project. Authorized was a channel 40 feet deep at mean lower low water (m.l.l.w.) and some 2,000 feet wide. This work was begun by the hopper dredge *Culebra,* prior to its transfer to the Seattle District.

Following work on the entrance to Grays Harbor, Washington, the *Culebra* returned to its dredging task at the Golden Gate. Once again, however, she was overhauled and then transferred to Seattle on April 13, 1925. By this time, the new San Francisco Harbor work was about 40 percent complete.

Though records are a bit sketchy, it seems that the *Culebra* returned to San Francisco, and by September 30, 1926, had completed

the new 40-foot channel through the outer bar. Over a million cubic yards had been removed during the course of this improvement work. With its labors finished at San Francisco, the *Culebra* was transferred permanently to the Seattle District on January 5, 1927.

Between the winter of 1927 and the autumn of 1937, the San Francisco Harbor project was modified and enlarged four times. The first of these was the dredging of Islais Creek Shoal to a depth of 35 feet between the years 1927 and 1930. Then, just as this project was finished, and following several years of studying and surveying the main portion of the bay in terms of navigation safety and needs, the San Francisco District began a variety of improvements authorized by the River and Harbor Act of July 3, 1930.

San Francisco Airport. Channel dredging by contract pipeline dredge Papoose *–December 20, 1940.*

District Engineer 1939-1940
Maj. R. C. Hunter

The 1930 project included the removal of Presidio Shoal, Rincon Reef Rocks, Blossom Rock, and Alcatraz Shoal to a depth of 40 feet; removal of Arch Rock, Shag Rocks and Harding Rock to a depth of 35 feet; removal of Raccoon Shoal and Point Knox Shoal, also to the 35-foot mark. By the mid-1930s, much of the work had been completed. The work at Presidio Shoal was finished in 1931, removal of various rocks in 1932, and further work on the bar channel in 1933. The following year, District personnel working under a Public Works Administration (PWA) project, completed the dredging of Point Knox Shoal and deepened the bar channel to 34 feet. By the summer of 1934, the authorization of 1930 was, when viewed in its entirety, considered about 60 percent complete.

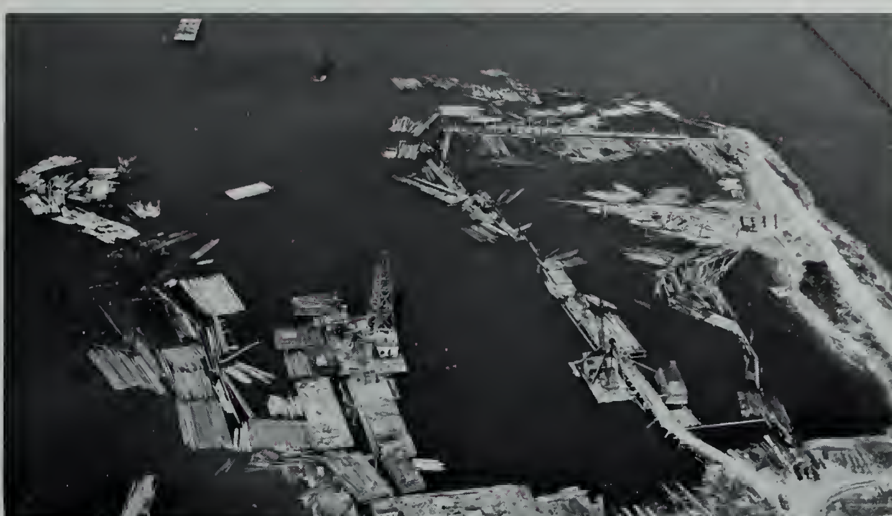
Just the next year (1935), the San Francisco harbor project was again enlarged by the San Francisco District. The River and Harbor Act of that year authorized the Golden Gate bar channel to be dredged to 50 feet, removal of Black Point shoal, and certain modifications of the areas to be deepened on Alcatraz and Islais Creek Shoals. Two years later, during the summer of 1937, the dredging of a channel to the San Francisco Airport was included in the overall harbor improvement project. A condition of the airport channel work, and one that would hold up the project for some time, was that local interests furnish, free of cost to the United States, suitably bulkheaded spoil-disposal areas for maintenance of the channel to the airport.

In any case, the hopper dredge *San Pablo* continued in its important role of dredging several projects within the harbor. Alcatraz Shoal was deepened in 1936, Black Point in 1937, and the channel and basin to San Francisco Airport in 1941. With the completion of this work, the project was considered to be about 90 percent complete. The only work remaining to be done was the completion of the bar channel, and the removal of Raccoon Shoal.

Drift Collection

During the sumnmer of 1942, a tragic accident served as the catalyst for an additional responsibility being given to the San Francisco District. For years, the presence of drift material in and on the waters of the bay had created hazards to navigation. Vessels were frequently damaged by hitting floating logs, old hulks and a variety of other debris. On foggy days or nights, the often partially submerged drift was an especially serious hazard. Seaplanes too had been disabled by encountering drift when landing on the bay. Finally, in spite of federal and other regulations against its discharge, oil was still found on the waters of the bay. The oil was a fire hazard itself, but when it accumulated with a quantity of floating debris, which often became lodged next to craft and water-front structures, a more serious hazard existed.

The San Francisco District, though concerned about the problem both in terms of navigation safety and water pollution, had



Debris lines the shore along Yerba Buena Island – August 1942. High tides washed much of it into the bay.

Floating debris in the South Bay area – September 1942.

never been authorized nor funded to clean up the floating mess. This was the situation in June, 1942, only six months after American entry into World War II. Following the attack on our Pacific islands, President Roosevelt made sweeping changes in the Navy High Command. One result of these changes was the appointment of Admiral Chester Nimitz to replace Admiral Kimmel as Commander in Chief, Pacific Fleet.

Things weren't going all that well for our forces in the Pacific during the early days of the war. Early in the summer of 1942, Admiral Nimitz, on board a seaplane, in company with other officers of the Naval High Command for Pacific Operations, was on his way to Washington, D.C. via San Francisco. While landing on San Francisco Bay, the seaplance struck a piece of drift. The bottom of the craft was ripped out, and the plane capsized. The pilot, killed instantly, was lost to the bay's water and never found. The Admiral, though bruised and shaken, escaped serious injury, and saved himself by climbing through the overturned hull.

Shortly thereafter, Colonel James Andrews Jr., San Francisco District Engineer, received word from the Chief of Engineers to

implement a program for the collection and removal of drift from the bay. The operations were initially carried on by a crew of civilian employees assisted by a detail of Navy enlisted men. Later the work was performed entirely by civilian crews. In addition to a program of inspection maintained on water-front construction and shipbuilding operations, the program of drift removal covered the Oakland Inner Harbor, the seaplane areas east of Treasure Island, the Alameda Naval Air Station, and the San Francisco Municipal Airport. These areas were swept daily, while other portions of the bay were patrolled on a periodic basis. Collections were also made upon receipt of information concerning the presence of drift.

The plant used initially for this work consisted of a pair of small tugs. The crews of these boats lifted smaller pieces of debris onto the decks by means of pike poles, and would raft larger logs and piles for towing. The collected drift was unloaded inside a log boom located at the westerly end of the Alameda Naval Air Station. The drift was then dragged ashore, piled, and burned in open fires. Costs for the work were charged to the annual maintenance allotments authorized for the existing projects for San Francisco Harbor, Oakland Harbor, Richmond Harbor, and San Pablo Bay and Mare Island Strait. The table below outlines the costs during the early days of this effort.

Fiscal Year	S.F. Harbor	Oakland Harbor	Richmond Harbor	San Pablo Bay & Mare Island Strait	Total
1943	$ 8,900	$ 6,000	$ 2,500	$ 8,900	$26,300
1944	6,300	6,300	4,200	4,200	21,000
1945	16,600	7,100	4,800	4,800	33,300
1946	33,000	7,600	4,600	5,100	50,300
1947	34,700	12,700	4,000	6,400	57,800

Refuse from Seadrome area – January 1945.

While the work done during the war, and the immediate years following, was relatively effective in eliminating the hazards to navigation, the San Francisco District believed strongly that a separate and permanent project needed to be authorized and funded to prosecute the debris-cleaning work so that this threat could be reduced to the lowest possible level. During 1946, the District Engineer reviewed earlier reports conducted by the Corps of Engineers (1919 – 1946) relative to various projects completed on the bay, and then sent letters to 125 agencies and individuals having maritime interests to determine the desires of local interests regarding drift on the waters of San Francisco Bay and its tributaries. All responded that drift was present in sufficient quantities to create a hazard to safe navigation. Moreover, it was the consensus of all concerned that a permanent program of drift removal should be instituted.

In addition, the District Engineer undertook field examinations to survey the type of drift present in the bay and the methods being used for its removal. The locations of drift in various portions of the bay were studied in aerial photographs and were checked by examination in the field. An office study was made of the methods and costs involved in the collection and removal of drift from the inception of the emergency operation to 1946.

From these and subsequent investigation, a report was formulated by Colonel S. N. Karrick, San Francisco District Engineer, in

A single day's collection of debris from the seaplane landing area in San Francisco Bay – October 21, 1942.

Debris collection crew – October 1946.

1948, and forwarded to the Chief of Engineers, Lieutenant General Raymond A. Wheeler (through the Division Engineer's office) on September 24th of that year.

Among the many statistics included in the report were those summarizing terminal and transfer facilities, and commerce and vessel traffic for the Bay Area. Apparently 1946 was the last year for which figures were available, because that year was used as the benchmark upon which to base the need for a separate project. From the report one finds that, at that time, there were some 340 commercial piers, wharves and slips on San Francisco Bay and its immediate tributaries, not including numerous small-boat landings and large military and other government-owned installations. Moreover, there were approximately 40 miles of improved waterfront facilities.

San Francisco District tug boat Lobos *brings a load of debris in from the bay in early 1950s to Sausalito.*

The waterborne commerce of San Francisco Bay and tributaries for the year 1946 is tabulated below (quantities do not include commerce carried by naval vessels):

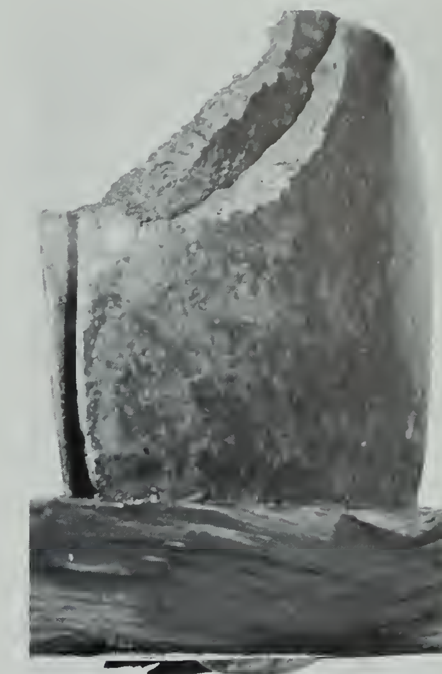
HARBOR	TONS
1. San Francisco Harbor	4,200,513
2. Oakland Harbor	4,976,334
3. Richmond Harbor	7,765,892
4. San Rafael Creek	53,081
5. Petaluma Creek	261,772
6. San Pablo Bay/Mare Island Strait	3,974,220
7. Redwood Creek (Harbor)	1,027,135
8. Napa River	242,670

The amount of vessel traffic upon San Francisco Bay and its tributaries is reflected by the following tabulation of commercial vessel trips for the year 1946.

Type of Craft	San Francisco Bay	Oakland Harbor	Richmond Harbor	San Rafael Creek	Petaluma Creek	San Pablo Bay/ Mare Island	Redwood Creek (Harbor)	Napa River	Total	Percent
Steamers	2,214	3,680	1,225	———	528	347	98	42	8,134	4.44
Motor Vessels	2,268	2,400	1,326	24	114	194	14	———	6,340	3.47
Tugs & Launches	75,604	23,134	9,329	353	1,970	6,056	3,612	788	120,846	66.09
Barges & Lighters	4,472	8,672	4,874	238	1,184	3,024	4,110	778	27,352	14.97
Fishing Craft	20,144	———	28	———	———	———	———	———	20,172	11.03
Total	104,702	37,886	16,782	615	3,786	9,621	7,834	1,608	182,844	100.00
Percent	57.26	20.72	9.17	0.33	2.07	5.27	4.28	0.90	100.	———

In the actual plan of improvement, the District Engineer noted that, based on his studies and experience gained in carrying out the temporary operation, the complete elimination of all drift would be neither feasible nor necessary. Thus, he proposed that only drift most dangerous to navigation, or likely to become so, be collected and removed. The scope of operations contemplated was as follows:

1. A continuous program of drift collection and removal to clear all areas, fairways, channels, and shipping lanes used for vessel navigation and for seaplane surface operations.
2. Drift removal from the shore line when and where there was a distinct possibility that it may refloat and become a hazard to navigation.
3. A patrol, coordinated with those of the Coast Guard, to search out and investigate concentrations of drift and engage in the enforcement of Section 13 of the the River and Harbor Act of 1899 to prevent the presence of drift on the waters of the bay.



Shattered power – Hit by a speeding motor boat in Oakland Estuary, this small, one-inch thick knotty board broke two blades of an outboard motor. The blade fragments stand three inches high on the water-logged board. Between 40 and 60 tons of drift are picked up from the Bay daily by Army Engineers debris boats. The drift menaces navigation, boating and hampers industrial operations.

It will be remembered that Section 13 of the referenced act made it unlawful to deposit any refuse matter from ships or shore into any navigable water of the United States, or tributary to such water, whereby navigation may be impeded or obstructed.

Because it was believed that the problems involved in drift collection and removal in San Francisco Bay were generally similar to those of New York Harbor, much of the rationale and plan developed in and for San Francisco was based on information from the New York District. Finally, Congress formally authorized the project, as outlined above, in the River and Harbor Act of May 17, 1950. To that time, the San Francisco drift collection project was one of only two such operations in the nation (New York being the other). So, from then on, the tugs *Hanson* and *Merryfield*, named for Corps of Engineers personnel killed in time of war, could carry out their assigned duties within the framework of an officially recognized project and not have to cover their expenses and justify their being as a maintenance item within various other projects.

Treasure Island

One of the most unusual projects completed by the San Francisco District during the period 1900 – 1950 was the creation of Treasure Island, in the middle of San Francisco Bay. Actually, a pair of local interest groups, unrelated to the Corps of Engineers, initiated the island-building concept. As early as 1931, civic leaders of San Francisco, under leadership of the San Francisco Junior Chamber of Commerce, expressed concern about the need for additional runways to handle the growing volume of air traffic serving the metropolitan area. Prodded by this group, San Francisco officials persuaded the California State Legislature to approve a measure transferring title of

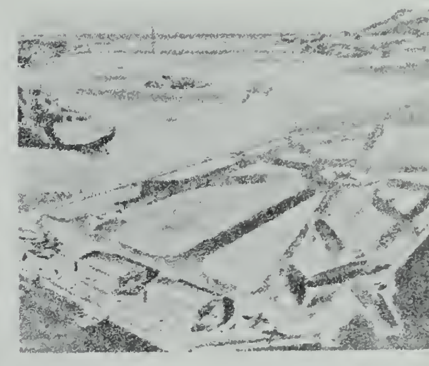
the Yerba Buena shoals from the State to the City and County of San Francisco for development as an airport.

During the same period, construction was begun on the Golden Gate and the San Francisco-Oakland Bay Bridge. The two great spans were hardly begun before there was a movement for a celebration marking their completion. This quickly grew into an effort for an exposition on an international scale. In October, 1933, San Francisco Mayor Angelo Rossi appointed a "Bridge Celebration Founding Committee," which promptly ran into a major problem — site selection.

A half dozen possibilities were advanced for consideration; Golden Gate Park, Presidio of San Francisco, China Basin, filled land south of Hunters Point, Lake Merced area, and the shoals north of Yerba Buena Island. The shoal area was chosen for two major reasons. It was equally accessible from communities on both sides of the bay, thus ending some of the community jealousies that had developed around the issue. Perhaps more importantly, the island to be created could later become an airport facility. By working together, the bridge-celebration group, and those interests pushing for a new airport were able to solve not only the issue of location, but that of financing the project.

Under the auspices of the City of San Francisco, the work was approved as a Works Progress Administration (WPA) project in 1935, provided that local interests furnished 20 percent of the total cost. The WPA authorization, including the 20 percent to be contributed by the local sponsor, amounted to $3,803,900.

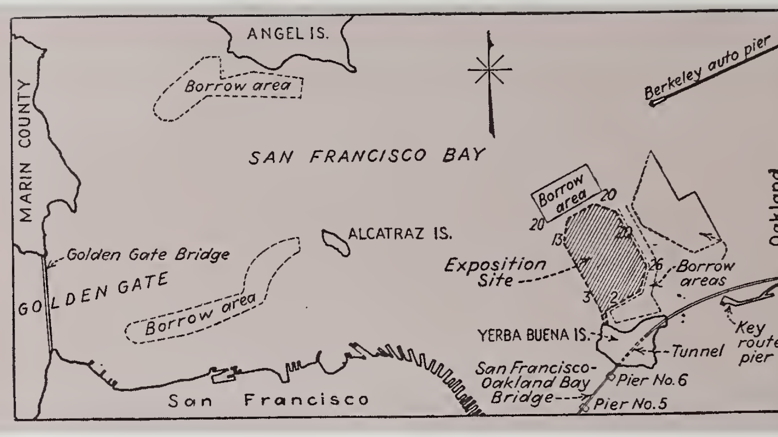
It was not long after the WPA authorization, however, that further study proved the job couldn't be handled by that organization. The WPA administrator turned to the Corps of Engineers, and on February 5, 1936, the Secretary of War approved his request that the project be undertaken by the Army Engineers.



Treasure Island was first conceived as a mid-bay air terminal.

Ferry boat pilots must have felt the end of an era was near as they guided their boats across the bay during construction of the Oakland-San Francisco Bay Bridge.

Yerba Buena shoals and dredge Sacramento *-- First fill March 2, 1936.*

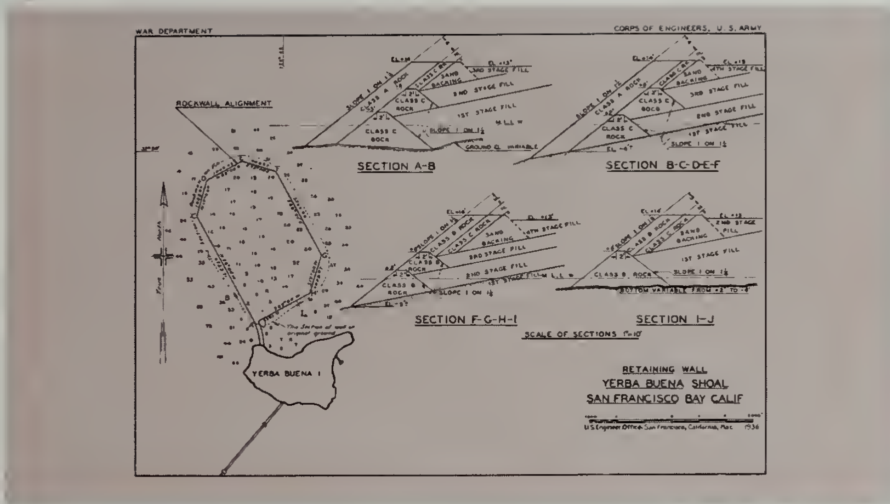


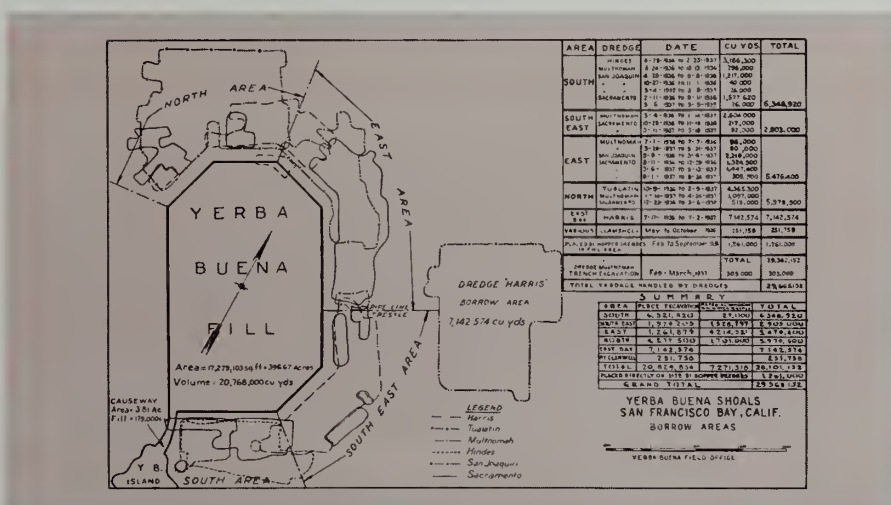
The next obstacle to overcome was that of financing the sponsor's obligation, which amounted to almost three-quarters of a million dollars. The City was in no position to advance the money without a bond issue; an unlikely source during the lean years of the depression. After considerable discussion, the Golden Gate International Exposition agreed to cover the sponsor's obligation. The initial funds were made available on February 7, 1936, just two days following the WPA/War Department agreement. Three days later, the San Francisco District started operations on the project.

The original plan anticipated only limited participation by government plant, with the major portion of the fill to be constructed under contract. This called for the use of one pipeline dredge, the *Sacramento,* in the area between the fill and Yerba Buena Island. In addition to the *Sacramento,* plans for the use of government plant contemplated the depositing of material on the deep, easterly portion of the area with hopper dredges. It was known that excellent heavy sand and gravel were available from three shoals in the westerly portion of the Bay, namely Presidio Shoal, Alcatraz Shoal and Point Knox Shoal. It was thought that the hopper dredges would be used only until the work could be assumed by private contractors.

Bids for the major portion of the fill, including the rock work, were advertised, to be opened March 4, 1936. No bids were received as a result of that call. Instead, a joint letter was presented to the District Engineer by several local dredging contractors in which they declined to bid, stating that they were unable to make satisfactory arrangements with rock contractors, and further that they believed there were insufficient funds allocated to see the project through to completion. Yet another reason given by the local dredgers was their fear of the weather conditions prevailing on the waters in which the work was to be done. Their concern was justified in that the shoal area is indeed subject to severe winter storms, as well as heavy wind and wave action during the summer months. As a matter of fact, there are very few months of the year which might be termed favorable for dredging. Besides the foul weather often visiting the area, the tidal currents are extremely powerful.

With conditions thus changed, immediate plans were made by the San Francisco District to complete the project with government





plant and such rented equipment as conditions warranted. As soon as instructions were received to proceed, a careful study was made of available borrow areas, and the work laid out accordingly. In view of the limited power of the government-owned pipeline dredges available, it was apparent that full use could not be made of the hard compact material of the east borrow area. Therefore, in addition to dumping material directly on the site, hopper dredges would be required to stockpile material which could be pumped onto the fill with government pipeline dredges at a later time. A schedule of operations was prepared which called for the use of the following government equipment:

Hopper Dredges:		*Pipeline Dredges:*	
	1. *Mackenzie*		1. *Sacramento*
	2. *Kingman*		2. *San Joaquin*
	3. *San Pablo*		3. *Multnomah*
	4. *Clotsop*		
	5. *Culebra*		

In addition to these, the basic plan authorized the rental of a pair of powerful pipeline dredges. Once again, however, problems arose relative to bidding on this phase of the work. Those received

were rejected, and negotiations were made with the American Dredging Company for the rental of the dredge *Harris,* the most powerful dredge on the Pacific Coast at that time. Subsequently, the dredge *Stetson C. Hindes* was rented from the San Francisco Bridge Company, and put to work on the project.

Soon thereafter, it was learned that instead of 85 percent of the dredged material being retained on site (as originally estimated), only 70 to 75 percent was being retained in place. It became apparent additional dredged material would be needed if the work was to be completed according to schedule. So, the dredge *Tualatin* was rented from the Hydraulic Dredging Company and assigned to the north borrow area, and went into operation in October, 1936.

As work on the project progressed, additional dredges were pressed into service. In all, three types of dredges were eventually utilized by the District engineers: hopper dredges, which sucked material from the floor of the bay and deposited it into bins, or hoppers, aboard the dredge itself; pipeline dredges, which fed material into lines depositing sand and gravel on the site itself; and clamshell dredges, the type which scoops up material in its jaws.

Treasure Island begins to rise from the bay.

The reclamation area in which the fill was to be placed varied generally from a minimum depth of two, to a maximum of 26 feet below low water. The total cubic yardage of sand, gravel and mud necessary to complete the fill was 29,665,152 of which 20,947,000 cubic yards remained in place. The remainder was lost due to wind erosion, settlement of fill in the original bottom, and loss of finely granulated material through flotation. The average cost per cubic yard placed, including overhead, was 11.2 cents.

The final quantity of rock used in the project, including the causeway connecting Treasure Island to Yerba Buena Island, was 285,773 tons. Much of this rock was used to construct the perimeter, which was completed first to afford a calm working area within the fill location and to provide a measure of shelter for dredges working on the west and north sides of the fill. The area encompassed, and eventually raised to an elevation of 13 feet, was approximately 5,520 feet long and 3,410 feet wide. The exact area measured 17,278,103 square feet, or 396.87 acres. The causeway added 3.81 acres to the total. A total of 1,223,374 man-hours of labor was expended on the project. Of this total, 278,838 man-hours of labor were secured from relief sources (present day semantics would identify these as welfare or unemployment rolls). The project was completed on August 24, 1937, and within 30 days thereafter, the entire force built up to rush the work to completion, was demobilized. Some of the men undoubtedly went to work on the exposition facilities, which were soon scheduled for construction. The cost of the reclamation, despite fears expressed earlier, fell well within the available funds. And as a matter of record, Lieutenant Colonel J. A. Dorst was District Engineer during construction; Captain F. B. Butler was assigned to the San Francisco District in early January, 1936, to take immediate charge of the work; and Mr. F. E. Frey was Job Engineer.

Once the island was completed, the Engineers had to leach the salt from the soil so that it would support vegetation. This was accomplished, in part at least, by drilling 200 wells on the still soggy island, and pumping them dry. Rain water also washed out still more salt. Finally, 80,000 cubic yards of rich peat topsoil were barged to the island from the Sacramento/San Joaquin delta area and spread over the surface for garden areas.

The next thing that needed to be done was to find an appropriate name for the new island. Legend has it that someone reasoned that because the island was made from bay bottom, carpeted with silt which had been carried down from the gold-rich Mother Lode region of the Sierra, the soil of the island must contain particles of gold. "Gold Island" just didn't quite have the correct ring, but when "Treasure Island" was mentioned, it had a natural sound to it. Thus, Treasure Island was born on November 21, 1937, when Bay Area dignitaries, San Francisco District personnel and local civic organizations participated in the dedication of the exposition site. Fourteen months later, the Golden Gate International Exposition, a 50 million dollar wonderland dominant by a slim, 400-foot, octagonal "Tower of the Sun," sparkled in the center of San Francisco Bay.

The exposition hailing the completion of the two gigantic bay bridges opened in 1939 and closed late in 1940. In addition to the "Tower of the Sun," the other dominant feature of the exposition was the 70-foot theme statue, Pacifica, a figure of a woman with her hands raised in benediction, symbolizing peace among the nations situated around the rim of the Pacific Ocean. Besides these, four main courts held long arrays of fountains, sculpture, flowers, bas-reliefs, and murals symbolizing the various Pacific cultures.

With the outbreak of war in Europe and America's mobilization for potential involvement, Treasure Island was turned over to the Navy. Several of the buildings used for the exposition, but designed for use as maintenance and operations facilities of an air terminal, were pressed into service to house, feed and process blue-clad sailors enroute to the Far East. The Hall of Western States was converted to a barracks, while the Food and Beverages Building was transformed into the world's largest mess hall. Even the old river boat, *Delta Queen,* which had brought thousands of visitors to the exposition, was used for quarters and classrooms. At the end of the war, Treasure Island served as the first U.S. stop on the homeward trip for hundreds of thousands of returning servicemen. Records of the time reveal that as many as 12,000 Naval personnel were processed there on a single day. Following the end of World War II, the Navy Department acquired permanent title to the island, and has held sway there to the present day.

Ground breaking – Treasure Island.

The San District looks with pride upon its contributions to the Bay Area during the first half of the twentieth century. Whether it was island building, ultimately for the Navy, channel and harbor improvements for commercial and military navigation, or the collecting of drift relative to safety and the reduction of marine pollution, the District's men and women worked tirelessly to better the economic and social position of those who made their homes and conducted their business on or near San Francisco Bay.

The Golden Gate International Exposition at Treasure Island.

Crescent City to Monterey 1900-1950

While the San Francisco District concentrated most of its energies within the Bay Area during the first five decades of the twentieth century, it didn't neglect the coastal harbors located both to the north and south of San Francisco Bay. In fact, just as it had done in the Bay Area, the District continued to build on the foundation projects of the previous century and, when and where deemed appropriate, responded to the needs of communities not served previously.

By mid-century, the San Francisco District had improved seven harbors on the coast in addition to those located within San Francisco Bay. From north to south these were Crescent City, Humboldt Bay, Noyo River, Bodega Bay, Half Moon Bay, Moss Landing and Monterey Harbor. Some were natural basins which lent themselves to convenient development, while others were little more than open roadsteads where harbors were practically created from engineering genius and little else.

Looking shoreward – July 1921, Crescent City Breakwater.

Crescent City Breakwater – May 1921. Battery Point Lighthouse is in the background.

Crescent City Harbor

Crescent City Harbor, originally called Paragon Bay, has been used commercially as a seaport since 1853, when the modest village of Crescent City was first surveyed and laid out into town lots. Initially schooners and side-wheel steamships brought supplies, machinery and building materials which had to be transferred to lighters and then unloaded on Crescent City Beach. From there it was carried by pack mules to the gold camps located several miles inland.

Shipping, in and out of Crescent City Harbor, continued as a lucrative business until about 1858, when news of the British Columbia gold strike all but turned the thriving hamlet into a ghost town, bringing a halt to commercial shipping. Then, in the 1870s and 80s, Del Norte County's gigantic supply of redwood began to be harvested. Commercial interests soon built wharves out into the harbor, resulting in the regular shipment of lumber and the transport of passengers.

As has been recorded earlier, the small harbors of the north coast suffered from the terrific winter storms that lash the area from the south and southwest. So even though the community contined to grow and prosper, expansion was retarded and commercial shipping stifled due to the harsh weather conditions coupled with an unimproved harbor. Local interests had, for years, beseeched the Corps of Engineers for assistance, but up until the period of the First World War, had not received favorable reports from the government relative to harbor improvement. Finally, after extensive investigations and in-depth reviews of the area, the San Francisco District submitted a favorable report regarding the development of the harbor.

In reports dated April 19, 1913, and January 31, 1914, the San Francisco District submitted a plan of improvement that called for the expenditure of almost half a million dollars. Following further study

Small work train returns to quarry after delivering stone to the end of the breakwater – July 1922.

and review, the District's plan was authorized in the River and Harbor Act of July 18, 1918. At about the same time, the people of Del Norte County bonded themselves in the amount of $225,000 so that harbor improvement could begin. Even so, it was nearly two years later before contracts were let, and the work undertaken.

During April of 1920, contractor William B. Arndt began building the breakwater designed to protect the harbor. As designed, the barrier was to be 3,000 feet long, 20 feet wide and from 6 to 11 feet above mean lower low water. Ten years and half a million tons of stone later, the initial breakwater was completed. It is a credit to the San Francisco District that when the job was finished in 1930, it had been done so with a savings of a quarter million dollars below the estimated cost.

Placing stone on the breakwater – July 1921.

Even before the work was completed, local interests began to add improvements of their own. Immediately following the completion of the first leg of the breakwater, the Hobbs-Wall Lumber Company built a dock inside the protected area and began the first really substantial lumber shipping program in Del Norte County. The Standard Oil Company of California erected dolphins inside the breakwater and began the importation of petroleum products by tanker. For their part, the Shell Oil Company built a long wharf from the east shore of the harbor to Pelican Rock and also brought in petroleum products by ship. While these are representative of the larger firms to take advantage of the new breakwater, many smaller companies — especially fishermen — benefited from the San Francisco District's labor.

Once the breakwater was completed, the District began dredging the harbor basin, allowing larger vessels to utilize the facility. Then, in 1937, the District secured authorization to construct the South Jetty, or "sand barrier" as it is known locally. When completed, this ran from Whaler Island to the easterly shore of the harbor.

Breakwater view is from Battery Point – July 1923.

Looking toward the ocean – July 1921, Crescent City Breakwater.

Quarry at Preston Island – June 1924.

By the summer of 1924, some 40,000 tons of stone had been removed from the Preston Island quarry. This is a view of the north pit of the quarry and the trestle.

Photo shows progress on breakwater to August 1, 1924.

The depression years and World War II had a negative effect on the level of seaborne commerce at Crescent City. Looking to better times, however, that would follow the global conflict, Congress, in the River and Harbor Act of March 2, 1945, provided for the extension of the original breakwater and for other improvements within the harbor. During 1946, the Basalt Rock Company was awarded a contract to build an inner jetty, as well as to extend the main breakwater. Two years later, the Macco-Morrison Knudsen Corporation was contracted to complete the main breakwater to Round Rock.

It is significant that each additional improvement authorized for construction by the San Francisco District Corps of Engineers brought almost immediate commercial activity, commensurate with the additional protection afforded. Commercial fishing expanded from a few boats, fishing haphazardly, to an impressive fleet of nearly 130 boats as soon as the small craft harbor was completed. The A. C. Dutton Corporation built a dock with complete lumber-loading facilities and began transporting lumber by sea to their east coast yards. The Sause Brothers Dock and Towing Company completely rebuilt their existing facilities and soon began barging both logs and lumber to half a dozen west coast ports. The Oil Terminals Company of San Francisco constructed a seven million dollar tank farm for the joint use of the major oil companies. Again, these are but a few of the many commercial activities stimulated in the immediate area of the harbor because of San Francisco District involvement in the region. When seen on a larger scale, the impact is even more impressive.

The overall economic and social effect on the trading area served by Crescent City Harbor encompasses parts of two states and several countries. Post World War II construction and harbor improvement by the Corps of Engineers had a tremendous positive effect upon the growth of this area. For instance, the population of Del Norte County on V-J Day was approximately 4,500, and by mid-century,

it had doubled. In 1946, where one or two rough sawmills existed, there were within a few years dozens of ultra-modern mills, lumber-processing plants and plywood/veneer facilities in the area tributary to Crescent City Harbor. In addition, many new businesses and small manufacturing concerns moved into the community to help swell the local industry. Before long, fishermen wanting to moor their boats in the small craft harbor had to place their names on an ever-growing waiting list.

By 1950, the work authorized to that time was about three-quarters of the way completed. In total, the project called for a rubblemound breakwater approximately 5,700 feet in length extending from Battery Point to Round Rock; a rubblemound sand barrier from Whaler Island to the easterly shore; an inner breakwater extending northwesterly from Whaler Island, so as to form a protected inner harbor for maintaining, by dredging, a basin 1,800 feet long and 1,400 feet wide to a depth of 20 feet at mean lower low water; for the removal of pinnacle rocks in the inner harbor and for maintenance dredging in the vicinity of the seaward end of the sand barrier.

Crescent City Outer Breakwater showing storm damage to barrier during winter 1949-50.

By the summer of 1951, the only work remaining to be done included the completion of the 1,700-foot extension of the main breakwater to Round Rock and removal of a pinnacle rock at the entrance to the inner harbor. The costs and expenditures for the project to that time were as follows:

	Regular Funds	Contributed Funds	Total
New Work Costs	$2,711,308.58	$217,115.54	$2,928,424.12
Maintenance Costs	$ 408,881.81	$ 27,884.46	$ 436,766.27
Total Costs	$3,120,190.39	$245,000.00	$3,365,190.39
Expenditures	$3,037,461.30	$245,000.00	$3,282,461.30

Crescent City Harbor forms a natural gateway to a considerable area in Northern California and Southern Oregon. This cove, which was little more than an open roadstead prior to development by the

Completed sand barrier – Crescent City, California – August 22, 1939.

San Francisco District Corps of Engineers, is situated at the extreme northwest corner of California — some 320 statute miles north of San Francisco and 314 miles south of the Columbia River. With the nearest fully protected harbors of Humboldt Bay 68 miles southerly, and Coos Bay more than 100 miles northerly, Crescent City Harbor is thus doubly important; it serves as the passageway for natural resources from, and manufactured goods to, the region and provides the critical margin of safety as a port of refuge, affording asylum for small and medium-size coastwise shipping. Working with dedicated local interests, the engineers from the San Francisco District facilitated the social and economic growth of this part of California during the first half of the twentieth century. Later we shall see how all concerned continued in the spirit of cooperation to ensure the unbroken development of Crescent City Harbor.

Humboldt Harbor

The San Francisco District engineers first began improvements to the dangerous entrance of this finest port on the Redwood coast in 1881. At first it was concluded that no permanent improvement could be made. Later, with great misgiving, a pair of stone jetties was put up to provide safe entry and exit to and from the harbor. Thus, by the turn of the century, the Corps of Engineers had completed a project but recently believed impossible to carry out.

No sooner had the jetties been put up than the monstrous sea waves, spawned by winter storms, began tearing away at the barriers' very foundations. The assault by the sea continued, pounding endlessly upon the newly built structures. Even so, the weakened jetties were doing the job intended for them by their creators. When the Engineers resurveyed the project during the summer of 1905, they found channel depths of 23 feet straight out to sea, 19-foot depths in the south channel, and 26-foot depths in the north channel.

The social and economic effect upon Eureka was also obvious. Within the first five years of the completion of the jetties, Eureka's population had grown from 7,000 to 12,000 persons, commerce had increased, deeper-drafted vessels were utilizing the harbor and more ships were regularly running to Humboldt Bay,. The 1905 tonnage equaled 930,050, and more than 32,000 passengers were carried to and from the harbor.

At about the same time, the San Francisco District, recognizing the demands of increased traffic on the inner harbor, and the devastation being visited upon the jetties by the winter storms, began preliminary examinations relative to the entire project. Shortly thereafter, under the direction of Colonel W. H. Heuer, District Engineer, a plan was developed to provide a channel for deeper-draft vessels to reach the principal Eureka wharves without lightening. The proposal called for dredging a path 18 feet deep-, 300 feet wide and

6,200 feet long, at an estimated cost of $83,000. On March 2, 1907, Congress adopted the project as outlined and, by the fall of 1908, the San Francisco Bridge Company had completed the work.

Throughout the greater part of 1910, work progressed on formulating a plan of operations for rebuilding the jetties and for carrying the plan into effect. For by that time, the need to restore the jetties was great, in that shipping was being handicapped by insufficient depth of water over the bar and by the crooked and constantly changing channel. This urgent condition was transmitted to Congress by District Engineer Lieutenant Colonel John Biddle. During the summer of 1910 the national law makers, urged on as they were by local interests and Colonel Biddle, responded to the need as presented, and authorized the reconstruction of the Humboldt Bay jetties.

Construction of a plant for receiving stone and placing it on (and in) the jetties during the following year was completed in February of 1912 — with the exception of a large crane that would be needed to handle the largest— size stone, to be placed at the outer edges of the jetties. On August 10, 1911, W. G. Corboley contracted to furnish half a million tons of stone and actually began delivery on March 6, 1912. It should be noted here that, because the Humboldt jetties probably experience the most severe wave attack of any similar structures on the west coast (or possibly in the entire world), the quantity of stone placed for repair has been, over the years, greater than that used for the original construction.

Since the engineers couldn't drive piles for a new trestle through the old stone, an experimental method, using ties imbedded in a concrete cap, was used. Steel rails were then attached, over which the locomotives and cranes could move for the placement of stone. The "cap method," it was expected, would have the benefits of withstanding heavy seas that broke over the jetties and would not be subject to the deterioration attendant with wooden structures.

The rebuilding efforts got off to a rough start. During the spring of 1912, fire destroyed the locomotive shed and damaged two of the engines used on the project. Then in the fall and winter, severe storms interfered to the point where, for several months, the concrete cap could be extended and stone was placed only five or six days a month. Even though inclement weather slowed the work, rebuilding of the south jetty was more than half finished by the summer of 1915. Moreover, channels within the harbor were extended across the shoals to Arcata, Samoa, and Fields Landing. Finally, in 1916, the reconstruction of the south jetty was completed. To further protect the work, a 950-ton reinforced concrete monolith was put in place at the end (or head) of the jetty, this being the most vulnerable and needing the greatest shielding.

Just as the south jetty was being completed and work on the north jetty was getting underway, an accident of significant proportions occurred, which dramatized not only the power of the sea off Humboldt Bay, but the urgent need for improving the entrance to the harbor.

As Jonathan Winship or Hans Henry Buhne could testify, it required a great deal of skill and a good bit of luck to navigate across the turbulent Humboldt Bar. Many a stout bark never made it, lending credence to the bar's reputation as a notorious maritime graveyard. During the century after discovery of the Bay in 1850, at least 43 vessels were lost on the bar.

Many vessels foundered outside the Bay, on treacherous North or South Spit. Shifting sand, riptides, and offshore currents made the portals of Humboldt a fearsome place.

On December 14, 1916, the United States Submarine H-3, sometimes known as the *Garfish*, grounded on the North, or Samoa Spit, while trying to enter the Bay. Coast Guard crews using shore-based lifeboats rescued her sailors, but the H-3 stuck fast. For the next week, Navy tugs and monitors hauled at the submarine, trying to pry her loose, without the slightest bit of luck. Realizing that more power was needed, Rear Admiral William B. Caperton, Commander in Chief of the Pacific Fleet, brought up his 9,700 ton flagship, the heavy cruiser *Milwaukee*. He had supreme confidence in her 21,000 horsepower and 24 tons of cable. Where lesser men and ships had failed, he would succeed.

Cables were attached to the stranded sub from the stern of the cruiser, while another was run from the *Milwaukee's* bow to a monitor, which kept the great ship pointed out to sea. As the stokers shoveled coal into the fireboxes, the *Milwaukee* belched black smoke from her four stacks and began to pull at the H-3. But the submarine refused to loosen her hold on the land, and then, something unforeseen happened.

Crewmen from the beached flagship Milwaukee. *Other sailors line the rail waiting their turn.*

The terrible strain parted a hawser with which the monitor was holding the cruiser's bow seaward. Within minutes, the *Milwaukee's* own cables dragged her onto the beach beside the H-3. Broadside to the shore, and canted at a 20-degree list, the once proud flagship lay helpless in the breakers. Eventually, the Navy removed her guns, engines and equipment, and scrapped the rest.

River-run gravel pit located approximately 13 miles from batch plant. Exceptionally clean and well-graded gravel was found. It was conveyed to the batch plant by contractor's fleet of nine trucks which were loaded by a 3/4– yard northwest shovel.

The Garfish *is stuck fast on the sands of Samoa spit.*

The H-3 was salvaged by a local contractor and ex-logger, Jim Fraser. Fraser jacked the submarine up as he had many a redwood log, and using steam engines and rollers, towed the undersea vessel a mile over the sandbar and slipped her into Humboldt Bay. From there, the H-3 was taken down to Mare Island and pressed into service as a training ship. Thus did the U.S. Navy, and all others who took notice, learn greater respect for Humboldt Bar.

During this same period, an event that went unnoticed outside the immediate area, but one of significance for the shipping interests of the Humboldt region, was the connection of San Francisco and Eureka by rail. In light of this, it is worthy to note that for the calendar year 1914, 818,458 short tons valued at $37,500,000 moved through the harbor. Tonnage for the following year had dropped to 600,000 tons, with a value of $29,300,000. Included in this traffic was material used in jetty building. By 1918, tonnage would be down to little more than 300,000 tons. While it is true that the war in Europe resulted in a shortage of vessels at Eureka — and over the West Coast generally — the impact of the railroad upon harbor interests should not be minimized. Quite simply, the railroad was moving many of the goods which had earlier been brought to and carried from Eureka by ship. In fact, by 1922, ship tonnage had fallen to 212,000 tons, with a value of less than 9 million dollars. This represented the low figure for many years and from that point on, the tonnage and dollar value would begin to increase.

Damage where breach in jetty occurred. In the background are seen temporary buildings, a part of the construction plant.

Reconstruction of the north jetty began in 1915 and continued over the next eleven years. Two factors were primarily responsible for the lengthy period necessary for completing the job — weather and money. The former was foul and the latter was in short supply. In fact, hardly had reconstruction efforts begun when the work had to be halted due to the exhaustion of funds. Following the passage of the River and Harbor Act of July 27,1916, work was resumed on the north jetty and extensive repairs made to the south jetty. Work was again shut down in July 1917, due to the exhaustion of funds.

A new appropriation became available the following month, but work couldn't resume in that it wasn't possible to obtain reasonable bids for furnishing stone. That same year, the engineers decided to build a railroad from the Government Reservation to the end of the Northwestern Pacific Railway at Samoa, a distance of some four miles. This was done to facilitate the movement of material to the construction site.

Within a few months, contracts were again let and stone was being received and placed at an average of 500 to 600 tons daily — weather permitting — until November, 1921, when once more funds ran out and work was suspended. Regardless of the uneven progress, however, improvements to the harbor did enhance overall maritime conditions, thus enabling vessels to enter and leave the harbor on schedule and providing a place of refuge during storms. This would be the pattern, in fact, during the next few years: work

Damage to head end of south jetty before repairs were started.

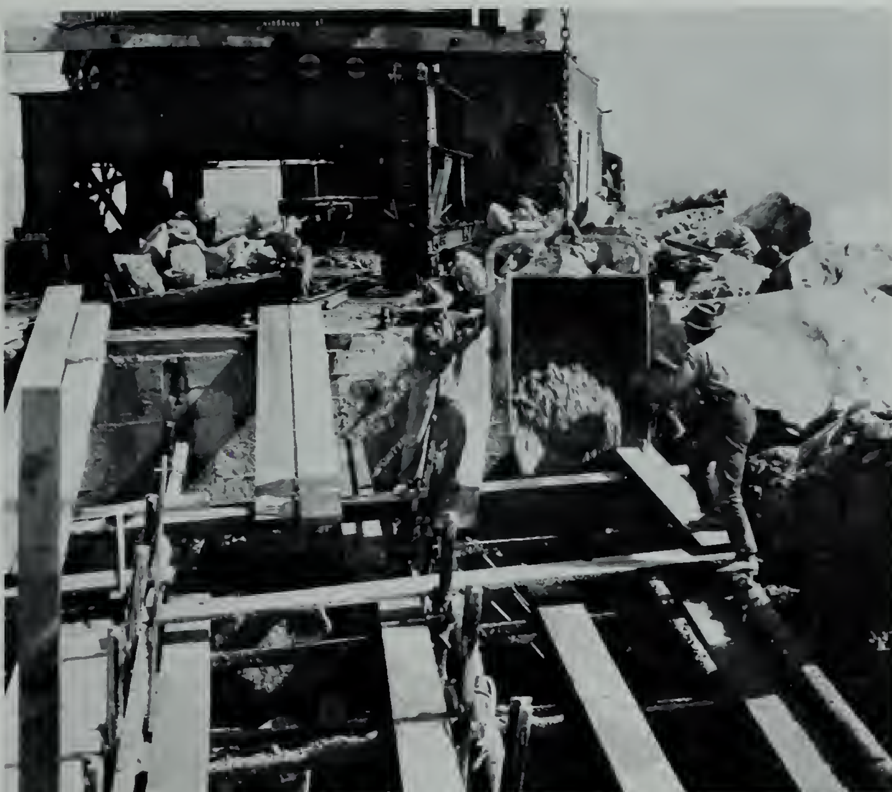
Improving Humboldt Harbor and Bay, South Jetty September 19, 1926. Tide – 2 feet. Constructing monolith station 90-78 to 91-15 – mixing plant.

Aerial photograph showing breach at shore end of south jetty. This breach was repaired by using mass concrete. January 1939.

being carried forward when funds were made available, storm damage repaired on both jetties, and harbor maintenance to assure adequate channel depths. Some years, however, were worse than others when considering the ratio of new work and repair efforts. A case in point was 1925, when severe winter storms washed away more than 42,000 tons of rock. During that year a total of 103,800 tons of stone was placed, of which more than 80,000 were for maintenance.

For all intents and purposes, the reconstruction of the north jetty was completed by the summer of 1926. By that time almost six and a half million dollars had been spent by the San Francisco District for the improvement of Humboldt Bay. Of that amount, $4,300,000 went for new work and more than two million was allocated for maintenance.

In 1930, the channel portion of the project received new authorization for expanding the depths and widths of the harbor's interior channels. This work required but a year to complete and was declared finished in July, 1931. Then, in 1935, Congress approved the enlargement of the entrance channel and related work. In August of 1937, approval was received to again enlarge the channels and to create a turning basin off Fields Landing wharf. All of this work was completed by 1939. From that time, until 1950, the San Francisco District prosecuted no new work, but tried desperately to maintain the existing jetties and channels.



Humboldt Bay – 1926. Improving the harbor and bay south jetty – September 17, 1926. Tide – 3 feet. Construction of monolith, station 90-43 to station 90-77 – pouring concrete.

Improving Humboldt Harbor and Bay, South Jetty – March 21, 1932. Tide – 4 feet. Ocean side looking shoreward from about station 89 + 40.

Tetrahedron forms placed in pit ready for pour. The crane has completed stripping a form and is placing it in curing yard. Later, a special "pulling frame" was used for loosening the block from form without moving the form from pit. This decreased the damage to form, decreased time of stripping and thus speeded up the whole operation of casting tetrahedrons. At right is shown the pre-cast blocks which were used for forms in pouring center of mass concrete.

During the 1930 s and 1940 s, emergency repair was the order of the day. Concrete was used to fill eroded areas in the crest and armor stone was imbedded on the side slopes to replace what had been washed out. In 1932, concrete blocks weighing over 100 tons each were placed on the jetties for protection, but simply disappeared during the winter's storms. Later, 12-ton tetrahedrons were used for

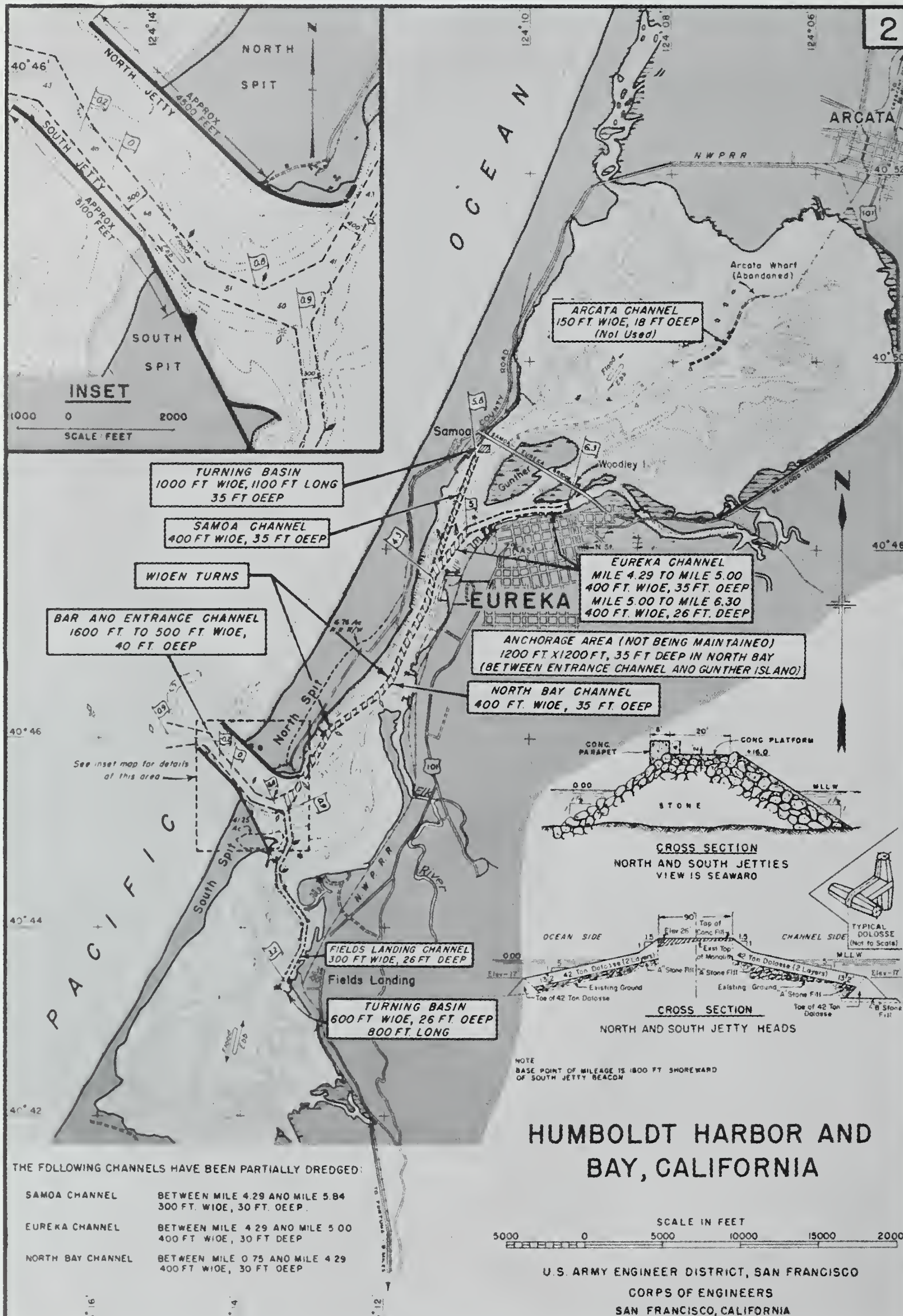
Lumber is loaded for trans-ocean shipment at Humboldt Bay.

South Jetty, Humboldt Bay. Placing tetrahedrons on south slope – September 25, 1939.

repairs. They, too, proved inadequate relative to long-lasting protection. Even though the San Francisco District and other Corps of Engineers agencies experimented with a variety of shapes and sizes of concrete blocks nothing, by mid-century, was found that could stand up to the terrible conditions of the North Coast.

Nonetheless, by means of constant vigil and indefatigable construction efforts, the San Francisco District engineers were able to maintain a safe harbor at Eureka. By 1950, the project of improvement included: a north jetty 4,500 feet in length and a south jetty 5,100 feet long; an entrance channel with suitable alignment 30 feet deep and 500 feet wide; a channel 26 feet deep and 400 feet wide from deep water in Humboldt Bay to the foot of N Street, Eureka; a channel 26 feet deep and 300 feet wide across Indian Island Shoal to Samoa; a channel 18 feet deep and 150 feet wide to Arcata wharf; and a channel 26 feet deep and 300 feet wide to Fields Landing, with a turning basin 600 feet wide and 800 feet long off the Fields Landing wharf. The costs and expenditures for the work, to the summer of 1951, were as follows:

	Regular Funds	Contributed Funds	Total
New Work Costs	$2,778,887.78	$ 95,000.00	$2,873,887.78
Maintenance Costs	$4,789,612.85	-------	$4,789,612.85
Total Costs	$7,568,500.63	$ 95,000.00	$7,663,500.63
Expenditures	$7,566,446.35	$ 95,000.00	$7,661,446.35



2
HUMBOLDT HARBOR AND BAY, CALIFORNIA
INSET
NORTH SPIT
NORTH JETTY
APPROX 4500 FEET
SOUTH JETTY
APPROX 5100 FEET
SOUTH SPIT
SCALE FEET
PACIFIC OCEAN
ARCATA
Arcata Wharf (Abandoned)
ARCATA CHANNEL 150 FT. WIDE, 18 FT DEEP (Not Used)
Samoa
Woodley I.
Gunther
EUREKA
TURNING BASIN 1000 FT WIDE, 1100 FT LONG 35 FT DEEP
SAMOA CHANNEL 400 FT WIDE, 35 FT DEEP
WIDEN TURNS
EUREKA CHANNEL MILE 4.29 TO MILE 5.00 400 FT. WIDE, 35 FT. DEEP MILE 5.00 TO MILE 6.30 400 FT. WIDE, 26 FT. DEEP
BAR AND ENTRANCE CHANNEL 1600 FT. TO 500 FT. WIDE, 40 FT. DEEP
ANCHORAGE AREA (NOT BEING MAINTAINED) 1200 FT. X 1200 FT., 35 FT DEEP IN NORTH BAY (BETWEEN ENTRANCE CHANNEL AND GUNTHER ISLAND)
NORTH BAY CHANNEL 400 FT. WIDE, 35 FT. DEEP
North Spit
South Spit
See inset map for details of this area
Elk River
N.W.P.R.R.
FIELDS LANDING CHANNEL 300 FT WIDE, 26 FT DEEP
Fields Landing
TURNING BASIN 600 FT WIDE, 26 FT. DEEP 800 FT. LONG
CROSS SECTION NORTH AND SOUTH JETTIES VIEW IS SEAWARD
CONC PARAPET
CONC PLATFORM
STONE
MLLW
CROSS SECTION NORTH AND SOUTH JETTY HEADS
OCEAN SIDE
CHANNEL SIDE
42 Ton Dolosse (2 Layers)
Existing Ground
TYPICAL DOLOSSE (Not to Scale)
NOTE BASE POINT OF MILEAGE IS 1800 FT SHOREWARD OF SOUTH JETTY BEACON
THE FOLLOWING CHANNELS HAVE BEEN PARTIALLY DREDGED:
SAMOA CHANNEL BETWEEN MILE 4.29 AND MILE 5.84 300 FT. WIDE, 30 FT. DEEP.
EUREKA CHANNEL BETWEEN MILE 4.29 AND MILE 5.00 400 FT WIDE, 30 FT DEEP
NORTH BAY CHANNEL BETWEEN MILE 0.75 AND MILE 4.29 400 FT WIDE, 30 FT DEEP
SCALE IN FEET
5000 0 5000 10000 15000 20000
U.S. ARMY ENGINEER DISTRICT, SAN FRANCISCO
CORPS OF ENGINEERS
SAN FRANCISCO, CALIFORNIA
30 SEPTEMBER 1976

Noyo River Harbor

The Noyo River takes its name from an Indian Village that was situated at the mouth of Pudding Creek, just a bit north of Fort Bragg. The harbor itself is a cove on the California coast about 135 miles northwest of San Francisco. Noyo River rises in the Coast Range Mountains, flows westerly and empties into Noyo Harbor.

The history of the port goes back to 1851, when a vessel loaded with silk and tea for San Francisco encountered a severe storm and was driven ashore at the mouth of Noyo River. When the party sent from Bodega to salvage the freight saw the timber along this part of the coast, they immediately carried the information back to San Francisco to those able to finance lumber operations. For the next 50 years Noyo was an important lumber town, and shipbuilding facility.

Fishing fleet at Noyo Harbor.

With the decline of lumber prices, many of its neighboring towns to the north and south were abandoned. Such was not the case at Noyo. The settlement flourished when other ports were fading due to the fact that it was the safest harbor between Humboldt Bay and the Golden Gate. In addition, the tiny port was able to make the transition from lumber to fishing, which it did around the turn of the century and thus ensured its survival.

While lumber processing and shipping continued to play a role in the harbor's economy — winter log storage on Pudding Creek, north of Noyo, was built in 1906 to hold 20 million board feet of redwood — it wasn't long before fishing boats displaced lumber schooners within Noyo Harbor. Moreover, a fishing fleet required a home port near its source of supply, unlike lumber vessels that simply needed a "dog hole" to do their business.

Noyo Harbor is roughly 1800 feet wide and 2000 feet long. In addition, the lower four miles of the river are navigable by small craft. Prior to improvement by the San Francisco District, a sandbar separated Noyo River from the cove into which it empties. The mouth of the river was at the south end of the bar adjacent to a 100 foot high cliff. Wave action carried sand and gravel into the river, building up a bar often two or three feet above low water. Then, during periods of ebb tide the river discharge would scour the bar out again — the process being repeated with each tidal cycle.

For years the Engineers had been examining the coves and inlets between San Francisco and Humboldt Bay for possible development as ports of refuge. And for years none was viewed as economically feasible for improvement. Following examinations and surveys carried out in 1918 and 1919, the Engineers decided that, finally, the situation at Noyo deserved to be improved.

It is difficult, from looking at existing records, to determine the exact reason for the change of heart, possibly the port's "harbor of refuge" qualities coupled with its development as a fishing center were enough to tip the balance. Whatever the case, reports dated May 16, 1919 and December 24, 1919, presented a $24,000 improvement plan for Noyo River, including an entrance channel across the bar at the mouth. The plan also proposed jetties and the removal of rock within the entrance channel to provide a depth of at least three feet at mean lower low water.

Local fishing interests gave their support to the plan as outlined, and urged the Corps of Engineers and their Congressman to support the project before the lawmakers in Washington. Both did so, and the improvement was authorized by the River and Harbor Act of September 22, 1922. Work was delayed at first, but eventually got underway and, by the summer of 1924, was considered complete. Almost immediately the desired effect was achieved. The jetties caused the entrance channel to deepen through the gravel bar at the mouth of the river, from about one foot above low water to three and a half feet below mean lower low water. As a result of the work, fishing vessels, because of the greater depth provided, were able to enter and leave the river at all stages of water except during the lowest of low

tides. Total expenditures for this work amounted to almost $22,000, including $18,500 for new construction and $3,300 for maintenance. Moreover, 9,000 tons of stone were placed in the north and south jetties. Economically, tonnage for the calendar year 1923 was 1,867 short tons, valued in excess of $350,000.

With the Corps of Engineers improvement came increased use of the port as a commercial and sport fishing harbor. Soon half a dozen wharves were handling tons of fish headed for the canneries. In addition, a substantial boat building and maintenance facility did a brisk business in the harbor, servicing the hundreds of gasoline powered fishing launches that used the port.

Due to the increase in traffic, and the size of vessels, the original project was expanded by the Act of July 3, 1930. The new authorization provided for an entrance channel ten feet deep and 100 feet wide and a channel in the river ten feet deep and 150 feet wide extending to the highway bridge at Noyo. This work was completed in 1931.

From that time until near the end of the Second World War, harbor work by the San Francisco District at Noyo was limited to maintenance of the existing jetties and channel — the repair of which was occasioned by the pounding they suffered at the hands of winter storms. It is of interest to note that the South Jetty of Noyo Harbor was

A Pacific storm batters the breakwater that protects Noyo Harbor.

undoubtedly the last concrete structure in the San Francisco District that was poured by using volume measurement for batching the concrete. "Bar run" aggregate was used and a "hopper" was constructed to measure the amount of aggregate required to yield one cubic yard of concrete. The hopper was constructed on the bluff southerly of the South Jetty and a "high line" was used to transport the bucket with concrete from the bluff to the south jetty and accomplish some dredging in the entrance channel to the harbor. This was probably the first time a "high line" was used to dredge a channel.

In May, 1945, the engineers received authorization to put up a 1,100 foot rubblemound breakwater to further protect the harbor. This latest project contained the stipulation that local interests provide necessary rights-of-way and easements for the construction and maintenance of the new breakwater, including access thereto and a suitable royalty-free quarry in the locality. In addition, they were to give assurance, satisfactory to the Secretary of War, that they would provide appropriate public facilities and arrangements for the loading and unloading of vessels within the harbor.

Even though the assurances weren't forthcoming, the San Francisco District began preliminary work on the breakwater. When it became clear that satisfactory guarantees would not be furnished for some time, work was halted. By 1950 only 15% of the work was completed, the same percentage recorded in 1946!

In 1948, Congress authorized the extension of the project channel an additional one-half mile upstream. At the same time, more requirements were placed upon the local interests. The Act of June 30, 1948, required that local interests establish a competent public body with the power to regulate the use and development of the port facilities — which were to be open to all on equal terms.

This regulatory body was also supposed to: (1) furnish, without cost to the government, all lands, easements, and rights-of-way necessary for the construction of the improvement; (2) agree to hold and save the United States free from damages resulting from construction and maintenance of the project; (3) provide spoils areas and (4) contribute half the funds necessary for the construction of levees, if and when they were required. These requirements, too, were still unmet by 1950.

Though the local people had trouble securing the necessary arrangements required by the District to put things in order so that continued improvements could go forward, they did nonetheless continue to better the facilities on a private basis. While there were no facilities in the harbor proper, in the river above the harbor eight privately owned wharves and piers, five boat-building and repair plants, a boat-fueling and icing terminal and a number of mooring appliances were servicing the expanding fishing fleet.

By 1950, more than a hundred boats were permanently berthed at Noyo, while hundreds more used the port during the salmon fishing season. Fish tonnage shipped from the harbor also continued to grow during the post-war years, and by mid-century more than 2,600 tons were being exported. Within a little more than a dozen years that

3
NOYO RIVER AND HARBOR
CALIFORNIA
SCALE IN FEET
500 0 500 1000 1500
U.S. ARMY ENGINEER DISTRICT, SAN FRANCISCO
CORPS OF ENGINEERS
SAN FRANCISCO, CALIFORNIA
30 JUNE 1970
PACIFIC OCEAN
NOYO HARBOR
NOYO RIVER
NOYO
FORT BRAGG
NORTH WALL
MOORING BASIN
8.5± ACRES, 10 FT. DEEP
CONSTRUCTED BY LOCAL INTERESTS
UPSTREAM LIMIT OF
FEDERAL PROJECT
CHANNEL
150 FT WIDE, 10 FT. DEEP
ENTRANCE CHANNEL
100 FT WIDE, 10 FT. DEEP
NORTH WALL
620 FT LONG
NORTH JETTY
345 FT LONG
SOUTH JETTY (WALL)
234 FT LONG
NORTH BREAKWATER
CREST 20 FT WIDE AT EL +20.0
Authorized but not constructed
SOUTH BREAKWATER
CREST 20 FT WIDE AT EL +20.0
Authorized but not constructed
HIGH LEVEL BRIDGE
VERT CL 90 FT
CROSS SECTION
NORTH JETTY
(OUTER END)
CROSS SECTION
SOUTH JETTY
NORTH BREAKWATER
SOUTH BREAKWATER
MASS CONCRETE
10 TON STONE
STONE ADDED IN 1954
Portions of Existing Wall Removed
Stone Added in 1961
Quarry Fines
Backfill
SEAWARD SIDE
CHANNEL SIDE
MLLW
Flood
Ebb
39°26'00"
39°26'30"
123°48'00"
123°49'00"

figure would grow to eight million pounds of salmon, sole and rockfish shipped from this modest little port carved from California's rugged north coast. Surprisingly, the San Francisco District had expended less than half a million dollars to improve the vital economic center snuggled in the river canyon just south of Fort Bragg.

Bodega Bay

The harbor at Bodega Bay is of importance for the same reasons as is Noyo Harbor. It is the only improved harbor in the 140 mile reach between San Francisco Bay and Noyo Harbor. It serves as an often critical harbor of refuge and as the home port for a commercial fishing fleet. The similarity also extends to its history as a lumber port turned fishing center.

Juan Francisco de la Bodego y Cauadra sailed the *Sonoma* into Bodega Bay in 1775 as part of his assignment to chart the coastline, a requirement for potential expansion of the Spanish presidios northward. Years later, however, when a large complement of Russian artisans and Aleut hunters arrived on the *Kodiak* in 1808, only Miwok Indians were on hand to greet them. Under the leadership of Ivan Alexander Kuskoff, agent for the Russian-American Fur Company, initial settlement and sea otter hunting was begun.

The following year, Kuskoff sailed north to company headquarters at Sitka, Alaska, with a cargo of grain and more than 1,400 otter pelts. He returned to the bay in 1811 to build Port Ramanoff, the settlement of Kuskoff, and to establish Fort Ross but a few miles up the coast.

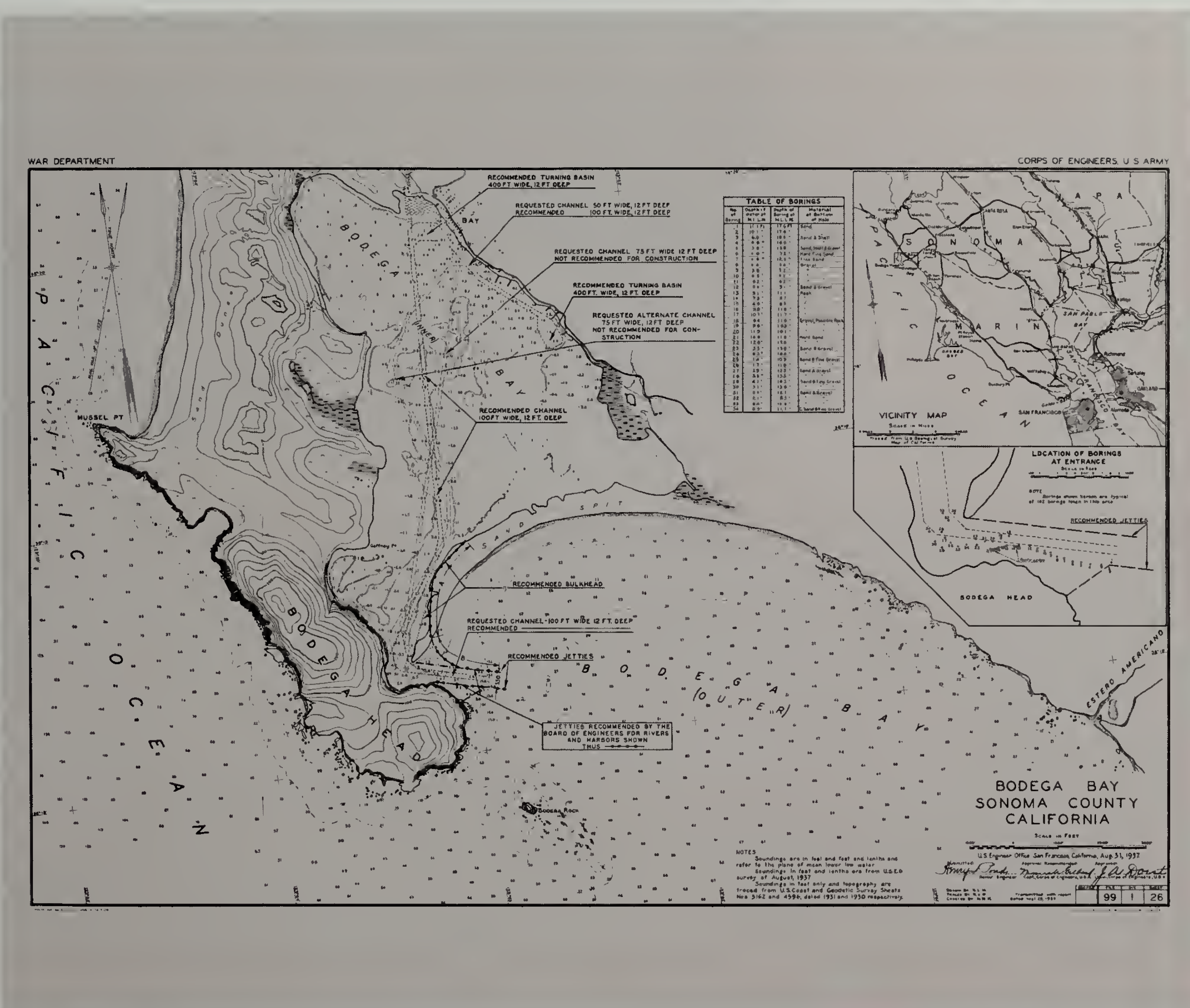
Kuskoff, built on the site of an Indian village, survived for some thirty years, during which time its inhabitants grew crops for export to fur posts in Alaska. When Russians withdrew in 1841, Bodega became a shipping point for fish, cheese and potatoes known locally as "Bodega reds."*

Shortly after Kuskoff was evacuated by the Russians, the land was acquired by Stephen Smith, a sea captain from the east coast, who became a Mexican citizen and married the daughter of a Californian. It was Smith who recognized the potential profit to be realized by cutting and shipping the vast stands of redwoods that crowded the hills and bluffs overlooking the bay. The transplanted sea captain built an adobe house on the site of Kuskoff and, by 1843 was operating California's first steam-powered sawmill. Just a year later, he gained title to the 35,000 acre Rancho Bodega—a tract that extended from Estero Americano to the Russian River. In addition to his place in history as the first American entrepreneur at Bodega, he is credited by many as the creator of the West Coast lumber trade when he purchased the bark *George Henry* to carry redwood lumber to San Francisco during this same period. Finally, Smith's extensive holdings were put asunder during the 1850s, when displaced gold seekers squatted on his land and engaged him in what became known as the "Bodega War."

The village of Bodega Bay is perched on the slopes of Mount Roscoe. Hardly a trace of the Russian presence remains; rather, the settlement appears to be a transplanted New England fishing village. Some four miles from Saint Teresa's Church, built in 1862, the old Potter Schoolhouse and the other quaint buildings of the town, lies Bodega Bay, a triangular lagoon on the California coast 58 miles north of San Francisco.

*With the seals and sea otters practically exterminated from the California coast, the Russians sold their holdings to John Sutter of gold rush fame. Sir George Simpson, Governor-in-Chief of the Hudson's Bay Company territories in North America, upon entering San Francisco Bay in December 1841, remarked with surprise, how the Russian settlers, about 100 men, women and children, the last remnants from the Bodega area and Fort Ross, were about to sail on the old, clumsy brig *Constantine*. On the one hand he admired their patriotic zeal, but on the other he was astonished to see them exchange the relative comforts of California for the dismal condition of Sitka (Alaska).

Bodega Bay



The first interest in the Bay, shown by the San Francisco District, was connected to efforts to develop a harbor of refuge on the north coast. For years, however, surveys and reports prepared by the District resulted in only negative recommendations relative to improvement. But as the redwood shipping trade began to slow in the area and as fishing became the prime economic activity sustaining the bay and the modest settlement around its shore, the Engineers from San Francisco were again urged to take another look at the facility.

From before the turn of the century up through the depths of the depression years, the Corps of Engineers repeatedly examined Bodega Bay. Even as late as the summer of 1932 though, records show that improvements were not deemed advisable. Sometime after that year, however, further study and perhaps at least some pressure by local interests caused the Bay to be seen in a new light.

Under the direction of Lieutenant Colonel J. A. Dorst, District Engineer, plans were prepared for the improvement of Bodega Bay during the mid-1930s and then submitted for review and approval by

View of discharge pipe near bulkhead.

Dredges at work in Bodega Bay.

higher authority. Finally, the project was adopted by the River and Harbor Act of June 20, 1938. For their part, the local interests were required to furnish disposal areas for maintenance dredging and to maintain suitable grasses and shrubbery to control the sands and dunes located west of the bay. Apparently the people of the area had some difficulty in meeting the requirements set down by the Corps of Engineers. It had been hoped that they would be able to provide the necessary guarantees by the fall of 1939, but as late as the summer of 1940 the prerequisites were yet to be satisfied. Sometime after that date, probably during 1941, local interests were able to secure the necessary guarantees and work by the Corps of Engineers got underway. By the summer of 1942 the project was reported as about 25% complete.

The project, as authorized, provided for an entrance channel 100 feet wide and 12 feet deep at mean lower low water protected by jetties; a channel of the same dimensions as the entrance channel to the town itself, and thence southerly along the shore for a distance of about 4,200 feet, with three widenings, or turning basins, 12 feet deep and 300-400 feet in width. One was to be located at the inner end of the entrance channel, the second at the junction of the bay and shore channels near the town and the third at the southern end of the shore channel. Finally, a suitable bulkhead was to be designed and built to prevent sand from the spit near the entrance being carried into the bay channel.

The jetties and bulkhead were completed in December, 1942, and the channels and turning basins during March, 1943. As is so often the case with north coast improvements, winter storms quickly attack the works, which then have to literally be rebuilt. Such was the situation with the jetties at Bodega. Following the first few winter storms, significant restoration efforts had to be mounted to maintain the integrity of the jetties. In addition, the San Francisco District conducted regular examinations and surveys of the harbor to monitor the controlling depths of channels and, when appropriate, authorized dredging within these channels to ensure safe passage for the fishing fleet.

On the average, exports of fish and shell-fish were just about double during the years following improvement by the Corps of Engineers. Below is a comparative statement of tonnage for the decade of the 1940 s:

Fish-Shellfish

Year	Ton	Year	Ton
1940	497	1945	1463
1941	369	1946	898
1942	562	1947	673
1943	643	1948	852
1944	947	1949	754

The increased numbers of fishing boats utilizing the harbor required improved loading and handling facilities. Though the enlargement of these was not terribly dramatic following harbor improvement by the San Francisco District, growth did take place in a steady and regular fashion. By mid-century seven piers, two of which had boat-fueling capability, were in service. Besides these, there was a pier constructed expressly for boat fueling. To round out the complement of ancillary appointments found here were boat building and repair plants and numerous small, privately-owned landings.

During the decade of Corps of Engineers improvement at Bodega Bay, the costs usually amounted to slightly less than appropriations — demonstrating once again the careful planning and watchfulness on the part of the engineers from San Francisco. Total expenditures for the work to the summer of 1950 amounted to $641,800 for new construction and just slightly over $102,000 for maintenance activities.

By the 1950s the land and settlements around the bay had, in reality, changed little over the years. Except for the number of fishing boats and the fact they moved without sails, the early Russian and American settlers would have had little trouble recognizing the place.

Fishing boats ride quietly at anchor in Bodega Bay.

The point is, Corps of Engineers involvement at Bodega didn't in and of itself invite wholesale expansion and growth — it simply helped enrich the lives of those who worked on the ocean and lived near the bay.

Bodega Head – Showing the jetties and harbor entrance to Bodega Bay.

Monterey Bay

Located about 75 miles south of the Golden Gate, Monterey Bay has from the earliest times played an important part in West Coast history and has been seen as a place of great beauty. Even before American acquisition, visitors exhalted the fairness of the area. Richard Henry Dana stated quite simply that Monterey was decidedly the pleasantest and most civilized place in all of California. Later, Robert Louis Stevenson was so impressed by the Monterey Bay area that he was inspired to use it as the setting for *Treasure Island.*

In few other regions has nature worked with such consummate skill. From the dune country below the Salinas River to the white beaches of Asilomar and Carmel, one encounters magnificent panoramas at every turn. Under a canopy of brisk, crystalline air, cypress and pine still march down the slopes to the pounding surf. The incomparable beauty of Monterey is reflected in the writings of Stoddard, Atherton, Austin, Steinbeck, Harte, Steffens and other skilled authors with the talent to mirror what nature has achieved in few places.

The bay's chief port is (and always has been) the city of Monterey. Following the excitement brought on by activities surrounding California's transition to statehood and the brief rash of commercial enterprise resulting from the Gold Rush, Monterey experienced decades of doldrum-like life. As late as 1861, William Brewer, in charge of the United States Government Survey, could report that Spanish was the prevailing language and that more than half the business houses were made up of liquor shops, billiard saloons and the like.

In 1869, a Scots pioneer named David Jacks leased the town's waterfront for a dollar a year from the city council, with the proviso that he construct a substantial wharf within six months. Though there was considerable rumor of corruption and much grumbling at the size of wharfage and docking fees charged, the wharf proved to be a boon to Monterey. Having surrendered her maritime supremacy to San Francisco during the Gold Rush and cut off as she was from the main current of California's economic life, her port kept alive Monterey's commercial vitality. Four times each week coastwise steamers called at the bay and took on cargoes grown on the nearby farms.

Until about 1885 the sleepy little port served as the head-quarters for whalers in pursuit of California grays and humpbacks. During this same period a colony of Chinese fishermen operated a fleet of about 30 boats from the bay. Once cured, the fish they caught were shipped to San Francisco and thence to the mines and foreign ports. It has been estimated that during the 1870s 100 tons of dried fish were being exported annually.

When the Southern Pacific Railroad laid down rails through the Salinas Valley, some of the large ranches were broken up and planted to wheat and other crops. Then, in 1874 a narrow-gauge line was extended to Monterey, which allowed the shipment of wheat to the port for transshipment to domestic and foreign markets. By 1888 the area was the banner grain-producing area of California. And, as has been recorded earlier, Monterey served as a lumber port until the local supply was nearly used up and the price of lumber declined generally. Much of the lumber shipped from the port passed through the planing mill of one H. Prinz, which opened in 1874 and supposedly could process 10,000 board feet every 24 hours working time.

It was also during the 1870s and 1880s that the beauty of the area became known and appreciated once again to the outside world. An Englishwoman, Lady Duffus Hardy, though describing the place as "dirty, dusty, and inhabited by rather lazy fold," nonetheless predicted accurately that Monterey would probably become one of the most delightful seaside resorts in all the world. Local businessmen soon began to exert their best efforts to advertise the many advantages of the country. But by the turn of the century, Monterey remained, for the most part, a settlement of half-dilapidated frame and adobe buildings, standing in various states of disrepair along twisting, dusty (or muddy) narrow streets. Despite growing signs of progress, Monterey's population never exceeded 2,000 until 1900.

The San Francisco District had shown interest in Monterey Bay for several years prior to the turn of the century, but never felt the little port deserved improvement. Soon, however, increased trade and expanded maritime activity within the bay would gain a favorable report from the engineers. The new trade patterns were the result of a wide variety of enterprises.

Toward the end of the 19th century sporadic attempts had been mounted to exploit the natural riches of the hinterland. Over rough sled roads, built through the wild canyons to the precarious coast, tons of tan-bark were dragged by mules, to be hoisted by cables to waiting

schooners. During 1898 alone, axmen sent out 25,000 cords, leaving 100,000 trees stripped naked to rot.

During the first years of the 20th century, lime kilns, coal mines, and diatomaceous earth operations, were keeping hundreds of men and scores of ships busy. In addition, fruit, honey, cheese (Monterey Jack) and a variety of farm products were being shipped from the modest port. In 1902 the United States Army reclaimed the dilapidated old Presidio of Monterey, thereby adding Government payroll to the local economy. That same year Monterey discovered its chief economic asset — the sardine, swimming by the millions in the waters of Monterey Bay.

What was soon to become the sardine capital of the world was, admittedly, a bit slow to realize the full value of the lowly fish. T. E. Booth, of the Sacramento River Packers' Association put up the town's first fish cannery in 1902 on the beach near the old Customs House. While he was packing and shipping four tons of the little fish each day by 1904 (in season), the sardine was still being used chiefly as bait for salmon. Even so, the economy of Monterey was on the rise and this, as much as anything else, prompted the San Francisco District to re-evaluate its traditional stance.

Examination and survey reports dated June 17 and December 16, 1909, outlined a plan of improvement estimated to cost some $800,000. Local interests were to put up $200,000 of the estimated cost and, interestingly enough, ensure that within a reasonable length of time, a standard gauge rail connection would be provided with the San Joaquin Valley.

By 1911, the Engineers were convinced that shipping facilities were inadequate for the prospective commerce of the port. Even that year, more than half a million tons of cargo were shipped from the bay. By the end of 1914, the commerce had grown to more than three-quarters of a million tons and exceeded four million dollars in value.

Under the direction of Colonel John Biddle, District Engineer to July 20, 1911, and Lieutenant Colonel Thomas Rees, Biddle's successor, a detailed plan of improvement was prepared and sent to Congress. The project was adopted on July 25, 1912, and provided for a 2,000 foot long breakwater which would be 15 feet wide on top and stand some 10 feet above mean lower low water. It was thought that such a barrier would provide the fishing fleet and the other ships using the harbor protection from storms and the heavy ocean swells that visited the bay. Unfortunately, the planned railroad venture failed, making it impossible for local interests to meet their part of the bargain. For their part, the Engineers waited patiently for the Monterey interests to satisfy that part of the legislation that demanded local cooperation.

Even without Corps of Engineers improvements the industries using Monterey Bay continued to expand, especially the fishing industry. In 1915 Peter Ferranti, an Italian who had worked on fishing boats in the Mediterranean, came to Monterey and introduced the lampara net, which resulted in significantly greater catches of sardines. Before long it became standard equipment for the whole

fleet and ended up revolutionizing the industry. In 1916 it was discovered that the bay's silvery horde was in demand throughout the world. Within the short space of 36 months, nine canneries were constructed at Monterey to process sardines for shipment worldwide. By the end of the first World War, some 30 plants were in operation.

Contrary to popular belief, the major portion of the sardine catch went for by-products: oil, meal and fertilizer. State law only required that the equivalent of 13 and a half one-pound cans of sardines be processed for human consumption from every ton of fish purchased by the canners.

Over the years many of the hand operations were taken over by machines, thus speeding the various processes and adding eventually to the congested conditions of the limited facilities. Each cannery dock was equipped with machinery for hoisting sardines from the boats and with a mechanical blower. The fish were pumped through the revolving blower by means of a salt-water pump to the scaler, thence over endless-chain elevators into tanks of water and into the cutting sheds. Next they were brought to the packing tables where they were placed in cans and cooked.

Sardines rendered into fish oil or fish meal were done so under extreme pressure. Oil was stored in metal tanks, while the meal was packed in 100 pound jute sacks. Large quantities of the meal were subsequently shipped to the Middle West and East where it was used as feed supplement by cattlemen, hog-raisers, dairymen and chicken ranchers. The fertilizer made from waste sardines was packed in sacks and shipped in open cars to avoid spontaneous combustion. By 1929, peak year for the industry at Monterey, the high catch enabled the 30 canneries along Cannery Row to produce 4,000,000 cases of canned fish. It also pointed to the need for harbor improvements.

May 1934. City of Monterey showing the harbor and breakwater built by San Francisco District.

The project of 1912 was dusted off, re-examined and then modified. On July 3, 1930, a new plan was authorized by Congress, wherein a breakwater 1,300 feet long was to be built. By 1934, the project was completed — at a savings of $165,000 under the estimated cost. Total cost for the work up to the summer of that year amounted to $445,000.

Hardly had the protective stone barrier been put up than plans were laid to lengthen it. The River and Harbor Act of August 30, 1935, authorized the extension of the breakwater to a length of 1,700 feet — just 300 feet short of the one designed for construction in 1912. It is interesting to note that this extension project was originally authorized as a Public Works Administration program on September 6, 1934.

The Monterey Harbor project was again modified by the River and Harbor Act of March 2, 1945. This called for dredging the harbor near the original municipal wharf to a depth of eight feet and for the construction of a sand trap, 500 feet long, to prevent further encroachment of sand into the protected portion of the harbor. The 1945 Act once again imposed requirements of local cooperation. This time, local interests were to furnish necessary easements for the construction and maintenance of the sand traps and were to bear the excess cost of placing dredged materials in disposal areas. For all intents and purposes the project, as modified, was completed by 1947. Total cost of the work done by the San Francisco District at Monterey Harbor by mid-century amounted to $721,245. Of this amount, $207,900 were contributed by the Public Works Administration.

Within the protected harbor the commercial facilities consisted of two publicly-owned wharves having about a half mile of berthing space, three boat-fueling stations, a pair of net-tanning plants, a like

Seals sun themselves upon the newly completed breakwater protecting Monterey Harbor.

number of machine shops, and other facilities for servicing the fishing fleet. Outside the protected harbor there were boat-building and repair facilities, 35 anchored floating fish-receiving hoppers connected by pipe lines to sardine plants ashore, two submarine pipe lines between tanker moorings and shore plants for handling petroleum products and other facilities for servicing fishing boats. Even though the facilities, in total, were considered by the Corps of Engineers to be adequate for the maritime trade of that time, they did recognize that congestion generally existed within the protected harbor because of a lack of sufficient protected anchor mooring space.

For years the fortunes of Monterey were tied to the sardine. Hence, a further word about this fish is required if one is to understand its full impact upon the community, its harbor (and Corps of Engineers program) and the economic and social development of the region.

For more than 50 years businessmen had beseeched the Corps of Engineers to improve the harbor. First, when it appeared that a protective barrier was going to be built, things went amiss because of failure of the railroad venture. Finally, by the mid-thirties things were looking up; a breakwater had been built, and the sardine catch, though at times not altogether predictable, seemed inexhaustible.

In the mid 1930s the annual catch was reckoned in millions of pounds, and Cannery Row was in its halycon day. Then the fishing industry suffered a sharp setback. Catches diminished irregularly for more than a decade, until in 1947 the sardines disappeared. The canneries closed, people went without work, and the area suffered. For years people speculated as to the cause of the seemingly overnight disappearance of the sardines. Everything, from "the bomb" to pollution and unfavorable moon conditions was blamed. To this day no one knows with absolute certainty what or who was responsible. Careful research, however, by American, Japanese and Canadian investigators has resulted in a plausible answer.

Wind and waves batter the harbor during February, 1948.

It seems that northwesterly winds were blowing stronger and the ocean near Monterey had become colder during the 1940s than it had been but a few years earlier. The difference in ocean temperature was apparently enough to delay the hatching of sardine eggs by several hours, thus retarding the development of the fry. In addition to posing a threat to their survival, the colder water stimulated the growth of the sardine's predators, the zooplankton, which increased twenty-fold. It is also believed that strong upwelling and current action may have dispersed the fry to areas unfavorable for normal development. Finally, the research teams found that the sardines had moved their spawning grounds far to the south, off the coast of Baja California and that even in those waters the fish were quite scarce.

Other research holds that at least three other factors have prevented the sardines revival: a small spawning population, heavy fishing, and competition with the anchovy for its food supply.

It seems apparent, then, that weather changes and perhaps other conditions — some of which may be man-caused — had brought about the near-demise of the sardine industry. These changes have had a profound effect upon the people of Monterey and thus upon the San Francisco District's activities in that area.

Moss Landing Harbor

An important, but little-known harbor of the Pacific Coast is located at the mid-point along the shoreline of Monterey Bay, just 15 miles north of Monterey and some 85 miles south of San Francisco. Moss Landing was established about the year 1865, when a transplanted New Englander, Charles Moss, settled near the banks of the Salinas River near the old Santa Cruz-Watsonville Road, a mile or so above the point where the stream swept across a final sand-pit and emptied into Monterey Bay. In a quiet cove of the stream Moss laid out a small boat landing, and built some barges, which served to transport the produce of the fertile, nearby valley to the profitable San Francisco markets, thereby saving area farmers a long, costly inland trek. Later, in partnership with a fellow named Beadle, Moss constructed a wharf to facilitate the loading of freight. In addition to its role as a port for the export of farm products, Moss Landing served, until 1888, as one of the most important whaling stations on the coast. For years the old station remained as one of the few landmarks of this adventurous calling of the sea.

Surveys conducted by the Corps of Engineers in 1854 reveal that the Salinas River, which drains an area about the size of the state of Connecticut, flowed along what is now Moss Landing Lagoon and emptied into the Pacific Ocean about one and a half miles north of the hamlet of Moss Landing. Later surveys, made by the San Francisco District in 1909-10, showed the river emptying into the Pacific at a point seven miles south of the town. Old-time residents of the region hold that the change in the river's course was caused by the earthquake of

Moss Landing was an important whaling station for years. This photograph, taken in January 1919, shows a whale about to be pulled into the processing shed.

1906. While there is no available record to indicate otherwise, it is known that after the change, the lagoon had an unstable intermittent entrance.

Several years after the quake, a timber pile wharf was constructed by private interests about 1,700 feet south of the present channel, extending from the shoreline into the bay for a distance of about 400 feet. The wharf was used primarily for unloading fish and for receipt of lumber cargoes from coastwise steamers. Unfortunately it could only be used during periods of fair weather, since it extended practically into the open sea. On three separate occasions the wharf collapsed when the bottom upon which it rested was scoured to depths of 75 feet, thereby uprooting the piles and throwing the deck into the bay. Violent weather and rough water not only hampered the handling of cargo, but also broke oil pipe lines and, in 1942, was responsible for the destruction and the subsequent abandonment of several fishing vessels.

With the increase in cargo vessels and fishing fleets during the 1920s and early 1930s and the resultant congestion in Monterey Bay, the San Francisco District was able to demonstrate the desperate need for protective works for vessels using Monterey Bay. Finally, as we have seen, the 1912 project was modified, authorized and built by 1934. But this provided only about half of the harbor space needed. Thus in the late 1930s, the Committee on Commerce of the U.S. Senate recommended that a harbor be established at Moss Landing to provide

additional protection for the fishing fleet and other commercial vessels operating in the area. Then, in 1943, the Office of the Coordinator of Fisheries in Washington D.C. advised the Chief of Engineers of the critical wartime shortage of fishery commodities and of the urgent need for expanding production and improving the efficiency of production facilities.

The Chief of Engineers, realizing that work at Moss Landing would probably have to be postponed until the end of the war, nonetheless transmitted his positive recommendation to Congress (via the Secretary of War) on May 31, 1944. This called for an entrance channel 200 feet wide and 20 feet deep from the bay to the inner lagoon, protected by stone jetties and a turning area 20 feet deep at the lagoon end of the entrance channel. In addition, the plan also envisioned channels 200 feet wide and 20 feet deep, extending northerly and southerly in the lagoon from the entrance channel for a total length of about 5,200 feet, with flared turning basins 400 feet square at the ends of the channels. Finally a wave trap was to be constructed to protect the shore opposite the lagoon end of the entrance channel. The San Francisco District estimated that the entire project would cost just under half a million dollars to build and then about $20,000 annually to maintain. The District Engineer recommended, as well, certain requirements for local cooperation, including the contribution of one-half of the first cost of construction. When authorized in March of 1945, the local interests had only to furnish the necessary rights-of-way and suitable bulkheaded spoil-disposal areas for new work and subsequent maintenance, when and as required. The authorizing legislation also contained the usual hold-harmless clause.

Realizing that completion of the entire project would require considerable time and would likely be put off until the conclusion of the war, the Coordinator of Fisheries, as part of his 1943 recommendation, suggested that dredging operations at least be accomplished as soon as possible. This led to Congressional authorization and subsequent appropriation of necessary funds for immediate construction of minimum facilities that would permit more advantageous use of the harbor. The emergency improvement plan upon which the authorization of funds was based consisted of dredging an entrance channel 200 feet wide and 15 feet deep and a channel in the lagoon 100 feet wide, 15 feet deep and 3,200 feet long. To provide a turning basin, the channel at the inner end was to be extended to 200 feet in width. Creosoted timber jetties were included in the plan to protect the entrance channel from shoaling until the time the rock jetties were built.

To get things underway, the contractor hauled in his knock-down-type cutter-head dredge *Beaver,* set up the pipe lines and began dredging operations in the lagoon. The initial spoil was pumped into the adjacent inland spoil areas which had been provided by local interests. Once these areas had been filled, spoil was placed on adjacent beaches. Meanwhile, the dredge, edging its way through the sand-spit to the bay, gradually brought the channel into being.

Within a few days after the dredging work was begun, the contractor set up his falsework for a pair of 5,000 pound hammer piledriving rigs at the points selected for the shore ends of the jetties. Driving operations were soon underway. The jetties were designed to withstand the force of a five-foot high wave and for the horizontal pressure exerted by a sand fill. Piling was driven to a maximum penetration of 20 feet, with the top of the piling at nine and a half feet above mean lower low water (MLLW), supported by batter piling driven at various intervals on both the seaward and channel sides of each jetty. Longitudinal 12″ x 12″ timber wales were then bolted close to the top of the piling and also lower down the piling.

Following in the wake of the pile driver, an air jet rig was used to drive timber sheeting to the top elevation of the piling. The sheeting was then securely bolted to both top and bottom wales and additionally sustained in place by transverse struts. At the seaward ends, additional rows of piling were placed eight feet opposite each main piling, with batter piling, walls and bracing support, all for greater protection of the outward sections.

When the channel dredging was completed to the planned 15 foot depth, and even before construction of the pile jetties was finished, the purse seiners plowed their way through the swells into the calm harbor. Moss Landing Harbor, courtesy of the San Francisco District, was in business!

Soon, local interests invested considerable sums in furthering harbor development. This included dredging in the lagoon outside the limits of the Federal project and construction and extension of wharves and related facilities.

Late in 1946, a pair of violent storms hit the Monterey Bay area in rapid succession, causing extensive damage to the timber jetties. Wave action, moreover, caused scour along both structures, undercutting the bottom of the sheet piling. A number of sheet piles were torn loose from the structures, leaving holes through which littoral sand was free to flow into the dredged channel and thereby congest it. Emergency remedial measures had to be undertaken.

Early jetties of trestle-work were later replaced with stone at Moss Landing.

Violent storms damaged the timber jetties at Moss Landing.

First, rock was placed along the shoreline at the south jetty in the form of a sloping bank revetment extending some 100 feet each way and turning into the entrance channel for about the same length. Similar work was also completed on the north jetty.

The next step was the placement of rock on both sides of the north jetty, with a top elevation at four feet MLLW at the seaward end, 960 feet from shore, working back to a general height of eight feet MLLW and rising over the beach to a minimum total rock depth of ten feet before finally tying into the shore revetment. Similar placement of rock was underway at the same time on both sides of the south jetty for a length of approximately 330 feet.

This formed jetties with top widths five feet each side of the timber structures and with side slopes of 1-3/4 to 1. The core of the jetties consisted of rock which graded from 10 to 50 pounds; the cushion rock ranged from 50 to 500 pounds; and the top layer of armor stone graded from 500 pounds to 4,000 pounds. Heavier stones up to five tons each were concentrated at the outer ends of the jetties for additional reinforcement. This work pretty much finished up the project as authorized in 1944.

Winter storms again, however, attacked the protective barriers, causing displacement of the stone and general deterioration of the work. To correct this, the third and latest improvement program at Moss Landing Harbor got underway in 1948 and was completed during the next year.

One of the major efforts was the reinforcement of the jetties. Additional stone was placed on both the north and south structures and the crests of both were raised to 12 feet MLLW along their entire existing length. Armor stone used on inner portions graded from one to two tons. Stone used for further reinforcement of the outer end of the north jetty weighed from two to over ten tons. In addition to the extra enrockment, San Francisco District personnel thought it prudent to extend the north jetty about 75 feet to afford greater stability and protection.

Difficulty was being experienced during this same period with erosion of the sandy side slopes along the inner channel leading into Moss Landing Harbor proper. Wave action on these inner slopes just shoreward of the jetties threatened to clog the channel with sand. Remedial action was imperative!

Placement of stone ranging in weight up to two tons was undertaken to stabilize these side slopes for a distance of 300 feet on the north side of the channel and 400 feet along the south side. In all, some 24,500 tons of rock were placed under the last major harbor improvement program. Over the years the rock has been quite successful in preventing erosion. By the same token, maintenance costs were substantially reduced.

An interesting footnote to the history of harbor development at Moss Landing concerns the San Francisco District's determination of just where to place the entrance channel. This is so because a submarine canyon — said to be larger than the Grand Canyon — extends seaward in Monterey Bay from Moss Landing. The 100-fathom contour of this canyon is less than two miles from shore and the 10-fathom contour is but a thousand feet from shore. The canyon appears to exert a quieting influence on sea and wave conditions in its immediate environment, a natural feature that made harbor development at Moss Landing by the Corps of Engineers especially favorable. These findings, together with the fact that the undersea canyon would apparently swallow any amount of shoaling without creating a future channel sand barrier were considered advantageous factors. Thus it was that the District Engineer recommended construction of an entrance channel that would connect the undersea canyon in the bay to the inner lagoon.

During the immediate years following improvement by San Francisco District, Moss Landing grew steadily in importance. Even though the decline of the sardine fishing industry hurt the community, just as it did Monterey and other West Coast fishing centers, industry located there and made up for that loss. And, it came to Moss Landing largely as a result of the improved harbor and related facilities.

Pacific Gas and Electric Company built an $80 million power plant at Moss Landing. Magnesium and refractory products plants of Kaiser Industries were located adjacent to the harbor and petroleum storage facilities were (and are) also maintained in the area. These and other industries are dependent, at least indirectly, upon the harbor facilities of Moss Landing.

Moreover, the harbor began taking on additional importance as a recreational port and a mecca for pleasure craft. By 1950 private interests were planning and building facilities for berthing pleasure craft — an example of which was the Elkhorn Yacht Club, which spent in excess of $100,000 — to provide a small boat mooring basin in the north end of the harbor.

In addition to the San Francisco District, credit for the development of the harbor and its facilities must be shared with the Moss Landing Harbor District, whose goal was (and is) to see continuous, orderly growth and expansion of Moss Landing.

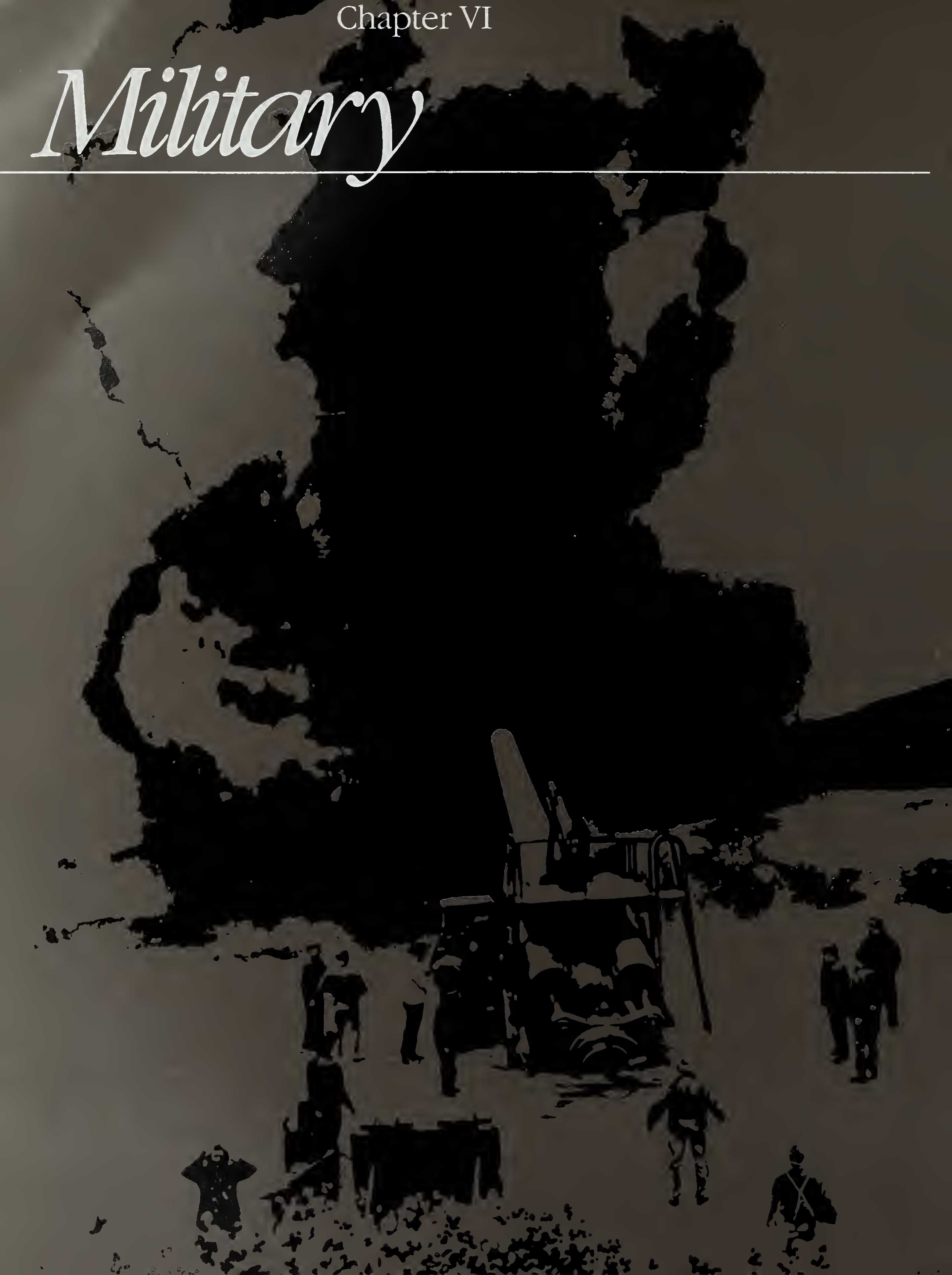
In summary, the creation of the harbor by the San Francisco District and private interests gave new impetus to the development of the Monterey Bay area as a major industrial and recreational center. More than that, Moss Landing Harbor is an important link in the chain of vital harbors along the Pacific Coast which contribute, not only to the economic welfare of nearby regions, but also to the pleasure and safety of those who work and play on the sea.

Moss Landing Harbor with new stone jetties.

Moss Landing fishing fleet crowds into the modest harbor on Monterey Bay.

Chapter VI

Military



Soon after the turn of the century San Francisco Bay — the heart of the District — was thought to be the most completely and scientifically protected harbor in the United States. The defense network put up by the San Francisco District was considered capable of repelling any fleet then afloat. More than that, it was designed to withstand bombardment by ships standing off our coast. The weapons for the most part were the products of evolutionary design worked out during the years following the Civil War, and would reach the peak of their efficiency during 1914. But, just as the Army learned the futility of building fixed fortification from bricks and mortar — a lesson brought home by the powerful new weapons developed during and after the Civil War — it would soon become aware of the terrible engines of destruction spawned during the First World War. Following our involvement in that conflict America would seek protection behind a screen of semi-isolation. Soon, however, the democracies of the world would be threatened by forces of a nature, and power, undreamed of in earlier times — and once again would have to respond by building newer, more deadly, defensive weapons.

Earthquake – 1906

In the meantime, however, forces building deep within the earth would explode throughout the San Francisco District, nearly destroy its chief city, and place the Corps of Engineers in a position to use its military strength for the protection of the local civilian population. At twelve minutes past five on the morning of April 18, 1906, the infamous San Andreas Fault, no longer able to stand the mounting pressures of the earth's crust, gave way under the strain, shifted terribly, and set off a tremor that raced down the length of the San Francisco District at more than 2,000 miles per hour. Unleasing more energy than all the explosives employed during the Second World War, it struck San Francisco with unprecedented force.

Large sections of the City crumbled in its wake. In doing so, gas and electrical lines severed, caught fire and set much of San Francisco ablaze. Brigadier General Frederick Funston acting in the stead of Major General Greely, Commander of the Pacific Division, watched the calamity unfold, analyzed the situation and took action. One of his first moves was to send word to Captain M. L. Walker, Corps of Engineers, at Fort Mason and tell him to mobilize his company of Engineers. Eventually their mission became two-fold: protect the civilian population and do that which was necessary to stop the fire.

Under Captain Walker's direction, the engineers dynamited

Market Street, April 18, 1906.

Opposite page: Target practice at Fort Barry – 1941. Men aim at a target some 12 miles at sea.

wooden shacks and lofty stone mansions alike to halt the inferno that was engulfing the heart of the City. That which wasn't actually destroyed was rapidly evaluated in terms of the benefits to be derived should destruction prove necessary. Examples of this were all of the buildings surrounding the various military installations should their demolition be required to save government posts. After the fire was contained, Captain Walker, acting upon civilian and military orders, was requested to turn out a detachment of Engineers to blow up weakened buildings and to demolish unsafe walls near the principal thoroughfares.

The constructive part of the engineers' mission was to build and supply refugee camps throughout the Bay Area and to restore essential services. For, it was estimated that in Oakland alone some 100,000 to 150,000 people were seeking shelter after their homes had been destroyed by earthquake and fire across the bay. Typical of the camps established in Oakland was the one put up by the engineers at Adams Point, on the north end of Lake Merritt, where they supervised the installation of water lines and sanitary facilities, in addition to actually constructing the refugee center.

Following the holocaust, General Greely directed San Francisco District Engineer (and Pacific Division Engineer) Colonel W. H. Heuer to carry out investigations relative to water supply, electric lighting, railways and all other services relative to the rehabilitation of the City. During the two months following the earthquake and fire Heuer did yeoman duty by personally assisting and guiding those under his command. In his report to the Secretary of War regarding Army activities associated with the disaster, Greely praised Heuer's work and stated that the Colonel's contribution was especially valuable.

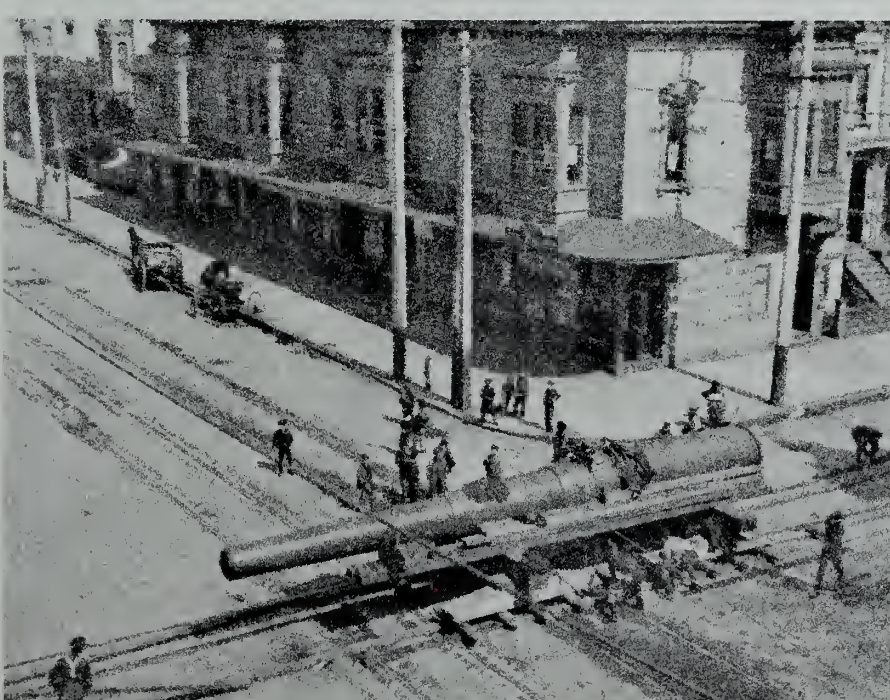
Down the years, the Corps of Engineers have given assistance many times, when the civilian population has been threatened by floods, earthquakes and other natural catastrophes.

Army nurses contributed to a significant degree during the emergency. Here seven nurses pose for a photograph at the Presidio.

World War I and The Great Depression Years

In 1914, the Chief of Coast Artillery, General E. M. Weaver reported that most of the guns protecting the shores of the United States dated back to designs developed in the 1880s and 1890s and could no longer be considered totally adequate. For, by the onset of the war in Europe, advances in modern naval armament were beginning to threaten the dominance of fixed fortifications over ships. Those advances were accelerated by developments achieved during the Russo-Japanese War and the construction of British Dreadnaught-class vessels. Thus, it became quite evident that a revision in coastal defensive planning was needed.

Ambitious plans were made beginning in 1915 for the improvement of San Francisco Bay's harbor defenses, which included new types of armament and battery designs. Just as the program was beginning to take shape, however, the United States, by the summer of 1917, was at war. It was soon realized, as well, that the enemy nations could pose no real naval threat to the West Coast. Of the many pre-World War I coastal defense projects proposed, only one was completed: the enlargement and arming of the Laguna Merced Military Reservation in 1917. This most southerly fort protecting the entrance to San Francisco Bay was built by the Engineers in 1898 during the



A 12-inch seacoast rifle moves through the City streets on its way to placement on the headlands north of the Golden Gate.

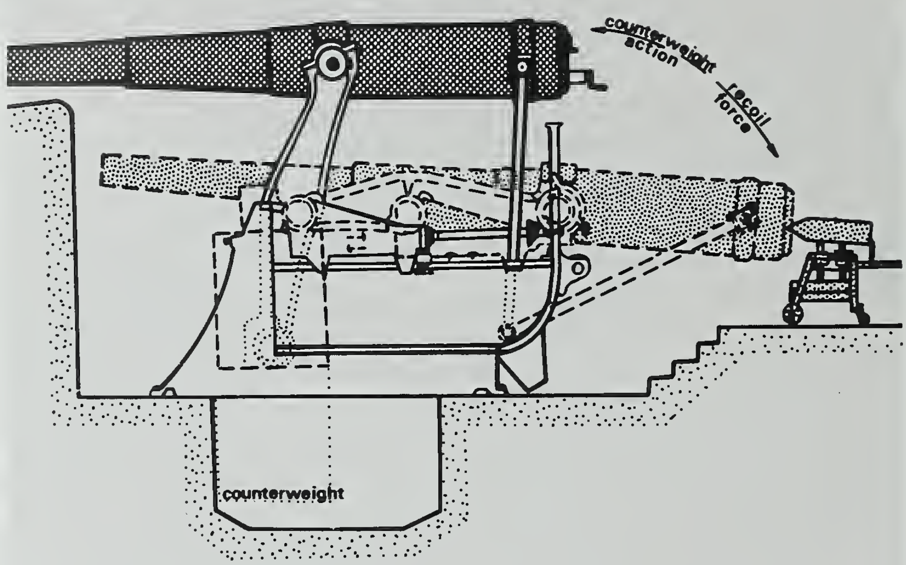
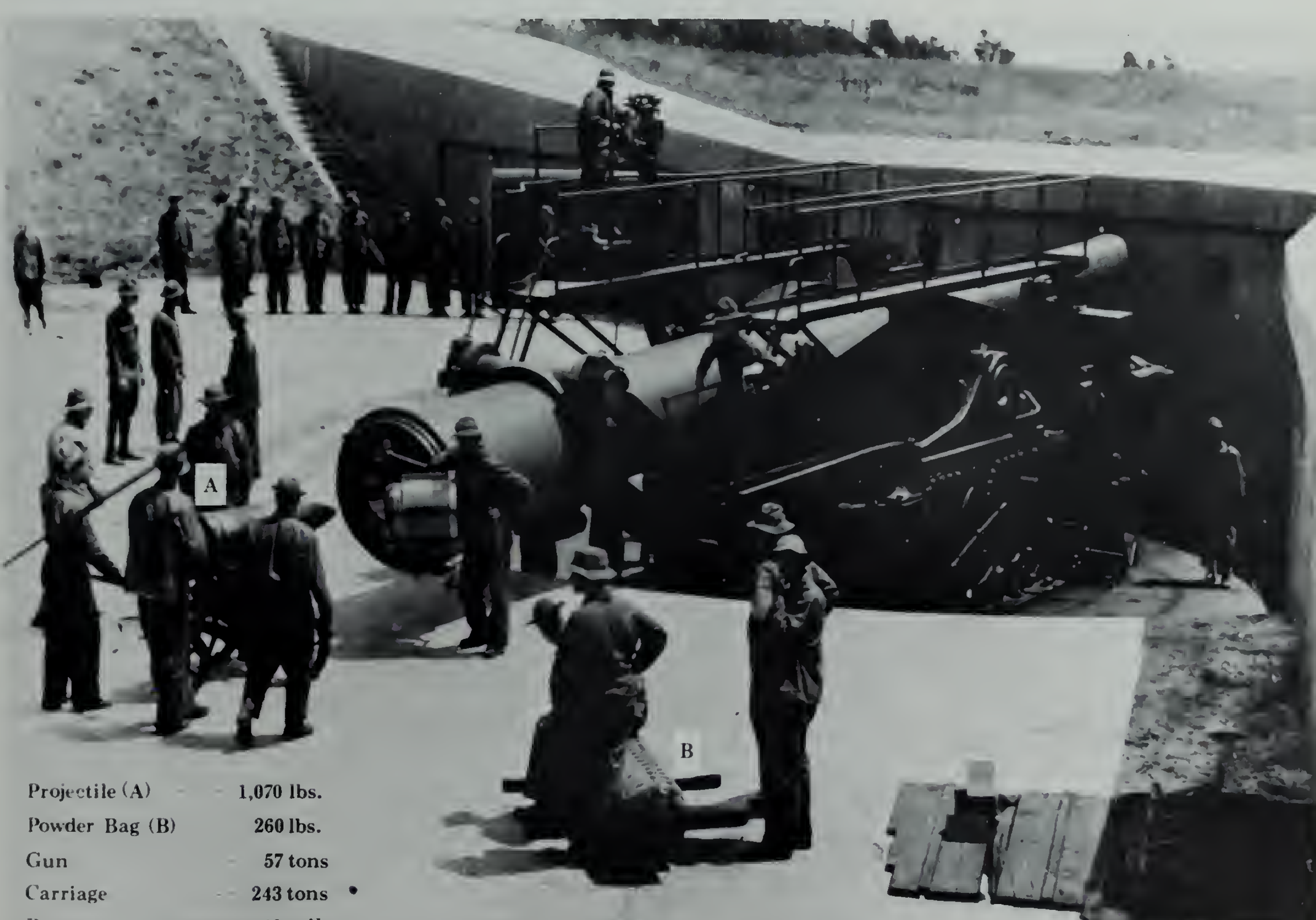


Diagram shows workings of 12-inch rifle.
Soldiers pose proudly with their huge gun.

Spanish American War. Early armament at Fort Funston consisted of Battery Bruff and Battery Howe. Bruff contained two 5-inch guns on pedestal mounts moved from the Presidio in 1917. These were subsequently declared obsolete in 1919. Battery Howe was armed with a dozen 12-inch mortars in three separate pits. The San Francisco District began construction of this battery in 1917 and had the work completed by 1919. That same year (1917) the post was renamed Fort Funston, to honor the general who died that year. So slight, in fact, was the perceived chance of an attack upon the Bay Area that as World War I progressed coastal defenses were stripped of armament for shipment to Europe for use as heavy field and railway artillery. Bay Area forts, as well as those located elsewhere, gave their share.

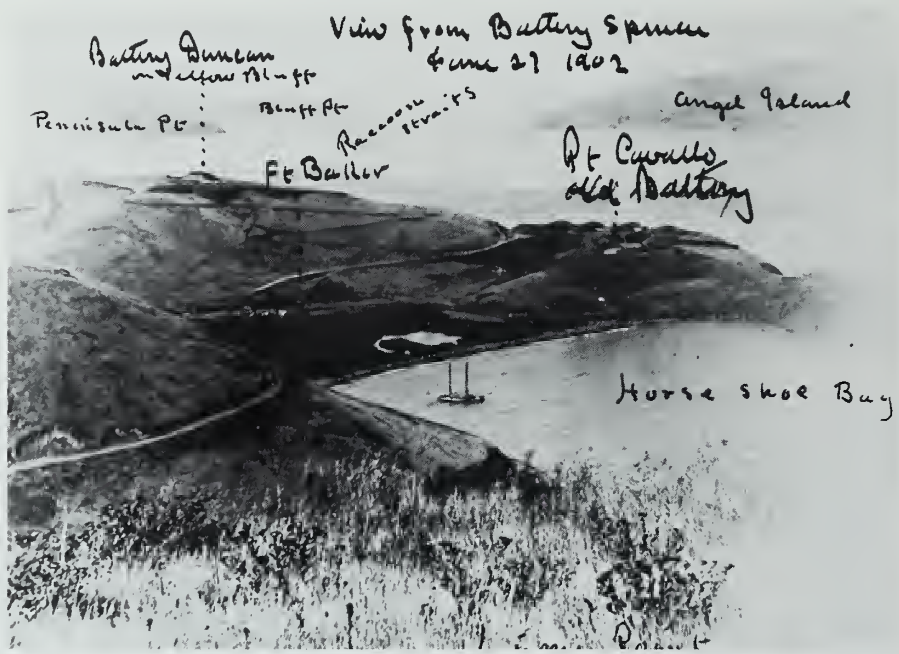
While many of the guns borrowed from the Marin County forts (Baker and Barry) were returned after the war, others were declared obsolete during the war and not brought home. Among the latter were the guns of Batteries Wagner and Duncan at Fort Baker. One of the three guns of Battery Spencer was moved to Fort Miley, south of the Golden Gate, while a Miley gun — a new model — was modified to be used as a railway piece for use in Europe. During the winter of 1917, a pair of 6-inch guns from Fort Barry were removed, refitted to field carriages and sent to a port of embarkation. Two years later they were returned and remounted.

12-inch seacoast rifle on disappearing carriage. Guns like this guarded San Francisco Bay in the early 1900s after Fort Point's guns became obsolete.



Probably the most ambitious piece of engineering accomplished in connection with San Francisco District's fortification work in those days was the construction of the Fort Baker-Fort Barry tunnel. This was a straight unlined bore through rock with a width and height of 16 feet and a length of 2,216 feet.

After the establishment of Fort Barry in 1904 as a separate post, travel between it and Fort Baker was a serious problem because of the intervening steep hills. Even before World War I, plans were made to shorten the difficult road by means of a tunnel. The possibility of American involvement in the war made the demanding transportation pattern untenable. During the war years construction efforts were



1902 photograph identifies various sites around Fort Baker.

Fort Baker – looking south to San Francisco.

A soldier checks out his machine gun at the Presidio.

A large gun, mounted on a modified rail carriage, is moved into place at Battery Mendell.

pressed, and the tunnel finally completed in 1918. This required the displacement of more rock than any project since Mendell's blasting operations at Lime Point Bluff! The tunnel was, for the most part, cut almost entirely through rock, although some of it was quite soft and crumbled. Consequently, it was necessary to line it with timber. This was done by placing 10″ by 10″ timber sets about five feet apart and covering them with 2-inch lagging. First cost of the tunnel amounted to approximately $136,000, but further expenditures totaling some $19,000 were made for maintenance work during the 1920s and 1930s.

Even though the San Francisco District was drained of men and material for duty overseas, many of the District's military posts saw new construction accomplished. This was done primarily in connection with work being done to establish training centers. The Presidio at San Francisco was a prime example of this effort.

By order of Major General Hunter Liggett, commanding the Department of the West, a new provisional brigade was created. Working in concert with the Constructing Quartermaster, the San Francisco District helped put up the temporary tent cities and permanent installations needed to house, feed and maintain the troops being trained. Throughout 1917 and 1918, the Presidio, in particular, was crowded with the tent camps of officer candidates.

On the site of the Panama-Pacific Exposition, originally built to

Fort Mason – 1921.

celebrate the opening of the Panama Canal, more than 200 buildings were constructed. These included single story barracks, lavatories, mess halls, post exchanges, storehouses and detention facilities. At least a few of these 1917-18 structures were still in use as warehouses as late as the mid-1950s.

Another example of temporary construction was Camp Fremont, located near Stanford University and the communities of Menlo Park and Palo Alto. By 1917 a small tent city was built, complete with messing capability, water supply systems, sanitary facilities, stables, and related structures required for training thousands of troops.

In January 1918, Colonel Curtis W. Otwell arrived at Camp Fremont from the Third Engineers, Hawaiian Department, in company with four officers and a detachment of 85 enlisted men. The group joined the Eighth Division and formed Company A of the 319th Engineer Regiment. Together they traveled and recruited throughout California, Nevada and Utah, and within 90 days the Regiment was fully organized.

The 319th became accomplished in all phases of construction and were soon on their way overseas. Arriving in France on October 13, 1918, they immediately set about the construction of debarkation facilities at Brest, a rest camp at Pontanezen and a water supply system.

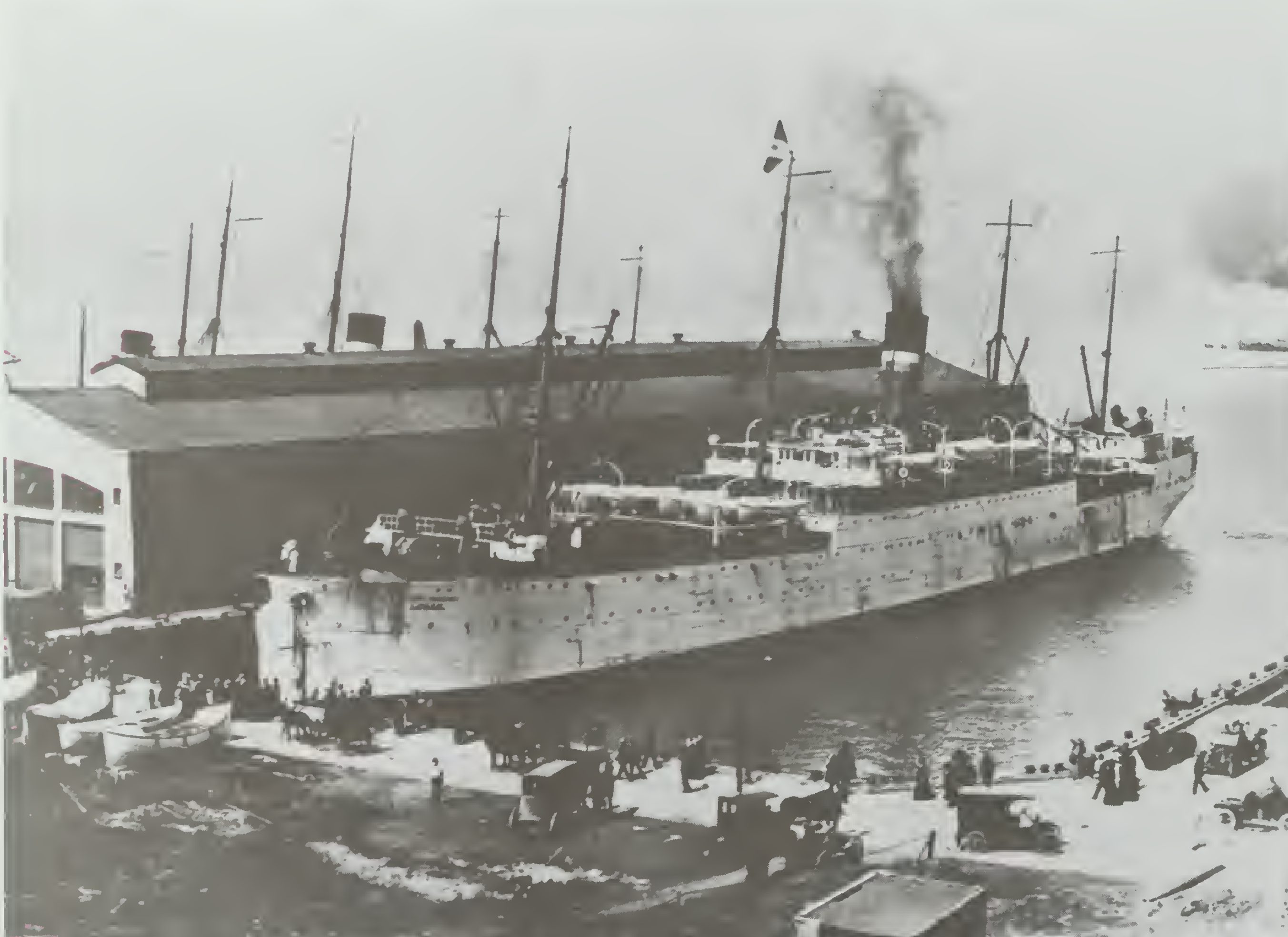
Above is typical large bore gun of type placed around the Golden Gate during the World War I period.

Following the armistice, the Regiment stayed on in France for several months and served as part of the honor guard to President Wilson upon his arrival in Europe.

Upon their return to the United States, most of the men were discharged. Colonel Otwell, however, continued in service with the Corps of Engineers, and eventually became District Engineer at Wheeling, West Virginia. It is worthy of note that another member of the 319th Engineer Regiment, James A. Dorst, also continued to serve with the Corps. Following a variety of assignments, and progression through the ranks, he returned to the West Coast in 1935 to take up the reins as San Francisco District Engineer.

Just as the last American soldiers were returning to the Presidio and other demobilization centers during the fall of 1919, yet another innovation of World War I — military aviation was having its impact upon construction on that post. The old race track located there, which had been alternately used as a supply dump, fabrication yard, parade ground and other sorts of things, was being converted to a modest, little airfield. It was Major Henry H. "Hap" Arnold, later commanding general of the Army Air Forces, who selected the site and became the field's first commander.

The transport Logan *ties up at Fort Mason during World War I.*



Again, working with the Quartermaster Corps, the Engineers had completed the facility to a point where it could play a role in the Army's transcontinental demonstration flight of 1919. Among the pilots taking part in that experimental flight was Major Dana H. Crissy, commanding officer of Mather Field near Sacramento, temporarily assigned to Fort Scott. Major Crissy was killed when his DeHavilland crashed near Salt Lake City. The tiny airstrip on the Presidio was named in his honor and dedicated Crissy Field on November 3, 1919.

The field really wasn't used a great deal until 1921, when hangars were completed and housing provided for Air Force personnel. Facilities were further expanded throughout the 1920s when the field saw service as an air mail depot and Army Air Field. By the mid-1930s however, larger aircraft, having higher landing speeds rendered the little strip obsolete. Planes that once used Crissy Field were transferred to the newly constructed Hamilton Field, located on the shores of San Pablo Bay near the town of San Rafael.

The proven effectiveness of the airplane during the world war impacted seacoast defense planning in two ways. For not only was the airplane a direct threat as an offensive weapon, it could, as well, be used to direct naval gunfire. This gave surface craft the capability of delivering their destructive power, with accuracy, upon fixed fortifications at greatly increased ranges. By 1920 entirely new concepts of fortifications began to develop in an attempt to neutralize the new threat. These concepts were mobility and dispersion.

The first of these, mobility, involved the mounting of guns on railway or tractor-drawn carriages, and then moving them where they were needed, or when necessary, out of harm's way. No railway artillery was utilized for the defense of San Francisco Bay. On the other hand four tractor-drawn 155mm rifles, riding on Panama mounts were eventually stationed at Fort Funston during the 1930s. It was not until after the attack on Pearl Harbor, though, that they would be placed in service north of the Golden Gate. Early in World War II these types of guns were emplaced by the San Francisco District at various locations along the coast, from Drake's Bay to the north and to Half Moon Bay to the south.

The second concept to evolve during the First World War — dispersion — was based on the need to separate the elements that had previously been concentrated into rather compact battery structures. Distances between emplacements that had originally been but 150 feet, such as Batteries Kirby and Mendell, were doubled and sometimes tripled. To further disperse the potentially explosive features of the batteries, service magazines in the new fortifications were removed away from the big guns. Ammunition was then brought to the battery proper by trucks, or in the case of a 16-inch battery using one-ton projectiles, by small railway carriages.

Battery Wallace's long range barbette-mounted 12-inch guns were among the first of the new-type fortifications. The Corps of Engineers worked out the plans for emplacement during 1917. This was a single-story structure with a pair of guns some 420 feet apart. The magazines were enclosed by a low, man-made hill to the rear,

covered by eight feet of concrete on top of which was placed another eight feet of earth. The San Francisco District completed the project during the late spring of 1921 and transferred it to the using troops on June 11, 1921. The completion of Battery Wallace marked the end of appreciable fortification work by the District in the Bay Area for more than a dozen years.

The military defense needs of the country brought on by participation in the war resulted in the expansion of the Army in general; expansion that was paralleled by the growth of the Corps of Engineers. Officer personnel of the Corps grew from 256 in 1916 to 11,175 by 1918. At the same time, the force of 2,200 enlisted men was enlarged more than 100-fold, to 285,000. Following the armistice however, the military strength of the nation was significantly reduced, as the country turned its face away from the martial arts.

The 1920s and early 1930s were years of strong antimilitary, isolationist feelings. While business interests, and agricultural groups wanted to loan money, sell goods and farm products to the decimated European countries, large segments of American people wanted never again to be drawn into foreign wars. Following World War I, the Army was dramatically reduced in man-power. This was reflected in the San Francisco's fortification work as well. Only two emplacements were built north of the Golden Gate during this period; Batteries McIndoe and Smith, each mounting a pair of 6-inch guns and completed in 1922. McIndoe was named to honor Brigadier General James F. McIndoe,* who died in 1919, while Battery Smith was named for Colonel Hamilton Smith, killed in action that same year.

For the Army as an organization, as well as for the Corps of Engineers, philosophy and direction during the post-war years emanated from the National Defense Act of June 4, 1920. The Act abandoned the old territorial division of the United States into military departments, but provided instead for a peacetime tactical as well as administrative organization. With the passage of the new law, the country was sectioned into nine corps areas, assigned to the headquarters of three armies. Under the new structure, the Corps of Engineers retained a force of 600 officers and 4,000 enlisted men — but a small fraction of its wartime strength.

Locally this was reflected in the limited construction of fortifications by the San Francisco District. By 1920 Fort Funston had been all but abandoned, while Forts Baker and Barry were placed in the hands of caretaker troops by the summer of 1922. Nonetheless, harbor defense planning, based upon experiences of World War I, and the military developments of the late 1920s and early 1930s, continued through the lean years in anticipation of the time when funds would become available. Planning emphasized the development of a relatively small number of standardized weapons to cover the entire range of coast artillery requirements.

Contrary to much recorded history and considerable popular

*McIndoe was Commanding Officer, Second Engineer Regiment, who died in France, February 5, 1919.

legend, the United States military establishment, though restricted by meager budgets and isolationist politics, was not blind to the developing offensive might of Nazi Germany and the Japanese Empire during the 1930s. For military planners, it was often not a question of what was needed but rather one of the specific form a weapons system should take. As early as the summer of 1935, members of the House of Representatives Appropriations Committee, mindful of the Japanese renouncement of the Five Power Naval Treaty, were impressed with the need to strengthen the Bay Area during their tour of West Coast military installations.

It will be remembered that this treaty, signed in Washington D.C. in February, 1922, limited the Japanese to 315,000 tons of capital ships. In 1930, the Prime Minister of Great Britain, Ramsay MacDonald, and President Hoover, called another Naval Conference to be held in London. The agreements signed there, extended the ban on capital ship construction for another five years (to end 1936) and continued limitations on smaller ships. Japan didn't like the terms of the treaty, and was able to gain some concessions from the other major powers. Then on December 29, 1934, Japan renounced the Washington and London Naval Treaties, and said that she would no longer be bound by them after 1936.

As a direct result of the House of Representatives tour and recommendations, a pair of 16-inch batteries were approved for the Bay Area. A "priority one" was given to construction of a battery at Fort Funston, while a second was authorized for Tennessee Point, north of the Golden Gate.

It must be remembered as well, that Japan had invaded Manchuria in 1931, and had attacked Shanghai in 1932. Moreover, Hitler withdrew Germany from the Geneva Disarmament Conference and the League of Nations in October, 1933. Then in March, 1935, just months before the Congressional committee's tour of Bay Area fortifications, Hitler declared the Treaty of Versailles limitations upon German armed strength no longer valid. He thereupon instituted compulsory military service, and began to build the German army toward an announced five hundred thousand men.

Designs for fixed fortifications were once again reviewed, analyzed and upgraded. It was George F. Crowe, then Chief of Engineering Design for the San Francisco District, who was credited with the formulation of the design of the 16-inch batteries to be constructed on both sides of the Golden Gate. Crowe's idea was to install a pair of 16-inch guns within enormous casemates, made of concrete and steel, and situated some 600 feet apart. Then, expanding on the post-World War I plans, he and his team designed a series of galleries for housing the ammunition magazines, electrical power generators, and related storage and operating facilities. The entire battery structure was to be roofed over for its entire length by eight to ten feet of densely reinforced concrete. On top of this, his plan called for the placement of twenty feet of earth, to absorb the initial shock from direct hits of projectiles fired from battleships or dropped from enemy bombers.

No. 2 gun tube on the highway—March 30, 1937.

One of those who did the initial survey and site work for the construction of the 16-inch batteries was William Angeloni. Angeloni served the District for more than thirty-seven years and became a bit of a legend in his own time. He came to the District in October, 1936 on a temporary assignment of eight months to work specifically on surveys for the construction of the first of the installations designed by George Crowe. Angeloni recalled that, once the survey and site work was completed, 16-inch naval rifles were secured, and construction was undertaken in November, 1936. This was at Fort Funston, located on the coast in the extreme southwest corner of San Francisco County.

Because the project was being built on sandy soil, special attention had to be given to the foundations. One of the District's Engineers assigned to the work was Otto Von Seggern. It was he who suggested that soil cement stabilization methods be employed. His suggestions were accepted, and the District contracted with the Portland Cement Association for assistance relative to the preparation of plans, specifications, field inspections and test. The soil cement methods utilized worked well, and provided a firm base upon which to construct the foundations for the heavy guns.

When finished in the late 1930s, the 16-inch emplacement was named Battery Richmond P. Davis. It is worthy of note that at that time

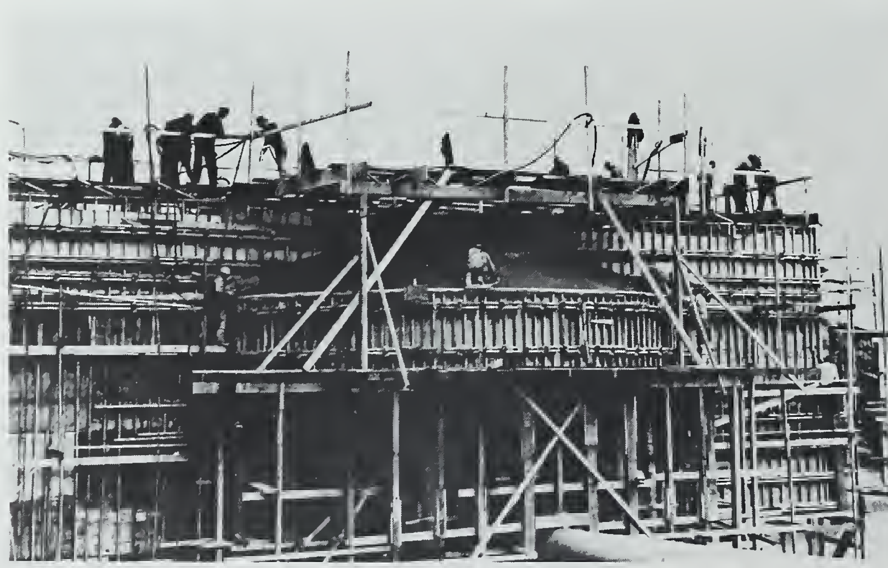
Gun block No. 1 during backfilling and tamping – Battery Davis – April 1937.

Battery Davis – Fort Funston. No. 1 gun block – placing the base ring, July 1937.

Battery Davis – Fort Funston, 1938 – photograph shows soil stabilization work.

Battery Davis – Fort Funston. Placing concrete in Burster Course, November 25, 1938.

Gun in place, February, 1938. Battery Davis – Fort Funston.



Placing concrete canopy above the big gun of Battery Davis – September 1938.

it was the most powerful fixed weapon on the West Coast. More than that, however, Crowe's new design concepts were at once the prototype and the standard for other such installations. Augmented by 155mm gun batteries, built during the same period, Fort Funston was indeed a powerful deterrent against seaborne attack.

The counterpart of Battery Davis, authorized for construction on the headlands north of the Golden Gate, was Battery Townsley. The idea for construction of a huge battery in that general location was first conceived in 1915. The First World War, new technology, limited funding and other considerations delayed its authorization for years — until the Congressional inspection of 1935.

Even though the 16-inch battery wasn't approved until the mid-thirties, other work was begun on the Marin County forts as early as the late 1920s. Fort Baker received modest attention in the late twenties, when repairs were made on the roads, wharf, and seawall. In 1925 and 1927, the lining of the tunnel connecting Forts Baker and Barry received needed attention in the interest of safety. Then, in 1932, a 134-foot extension was made to the Fort Baker seawall. It was constructed of concrete, reinforced with scrap iron found lying about the post!

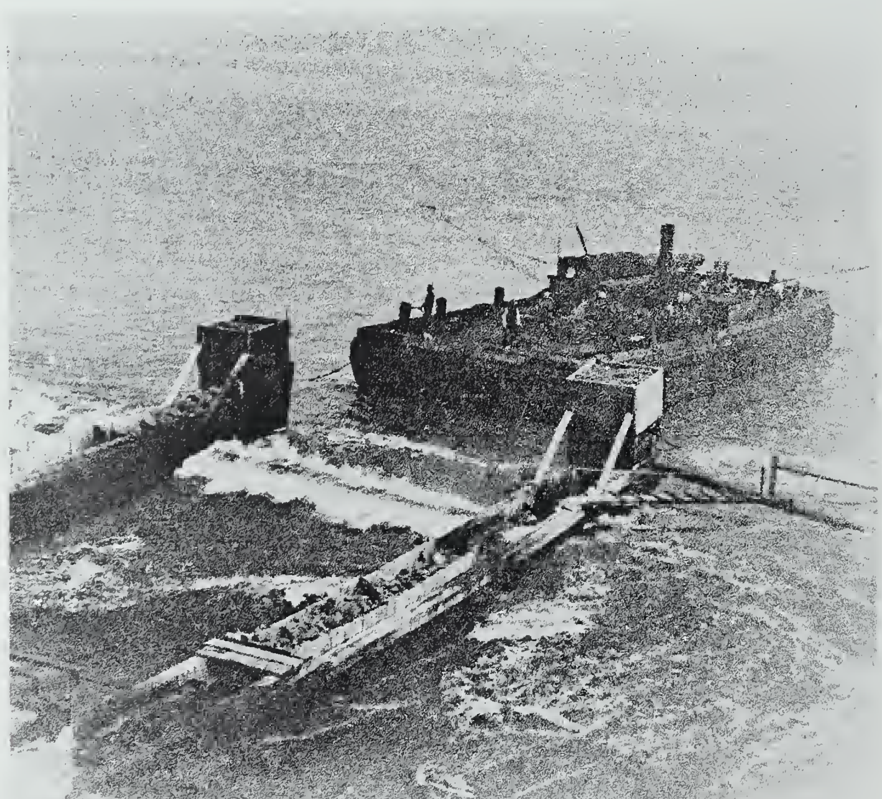
Battery Davis – October, 1938.

Battery Davis – September, 1940. Note the work done to conceal the big gun.

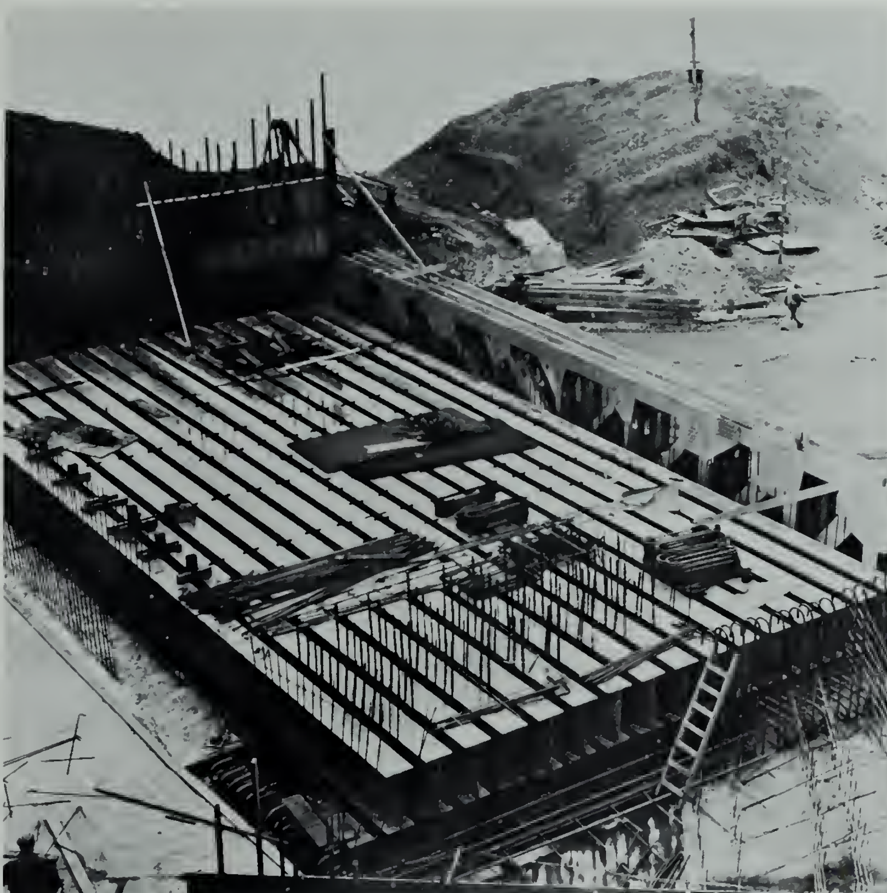
In response to the need to put people to work during the depression years, and to protect our shores against attack, the Federal Government began pouring millions of dollars into fortification rehabilitation projects. These combined factors brought an end to the general neglect of the post located to the north of San Francisco Bay.

Renewed activity in the Fort Barry area paralleled the government's concern for the development of defense installations against air attack. On August 12, 1935, the airspace over Fort Barry was set aside for governmental purposes. Civilian flights were no longer allowed over the area. Just a month later major rehabilitation of the fort was initiated, utilizing men from the relief rolls of San Francisco. The majority of this work was completed by the spring of 1936, but extensive construction was carried on into the war years. The new work finished during the mid-thirties included sewer system improvements, a guardhouse, dispatcher's office, motor sheds, housing and related facilities. As the threat of a new global conflict increased, work was expanded, and pushed forward even more rapidly. An example of this was the temporary housing put up in the Mendell Battery area.

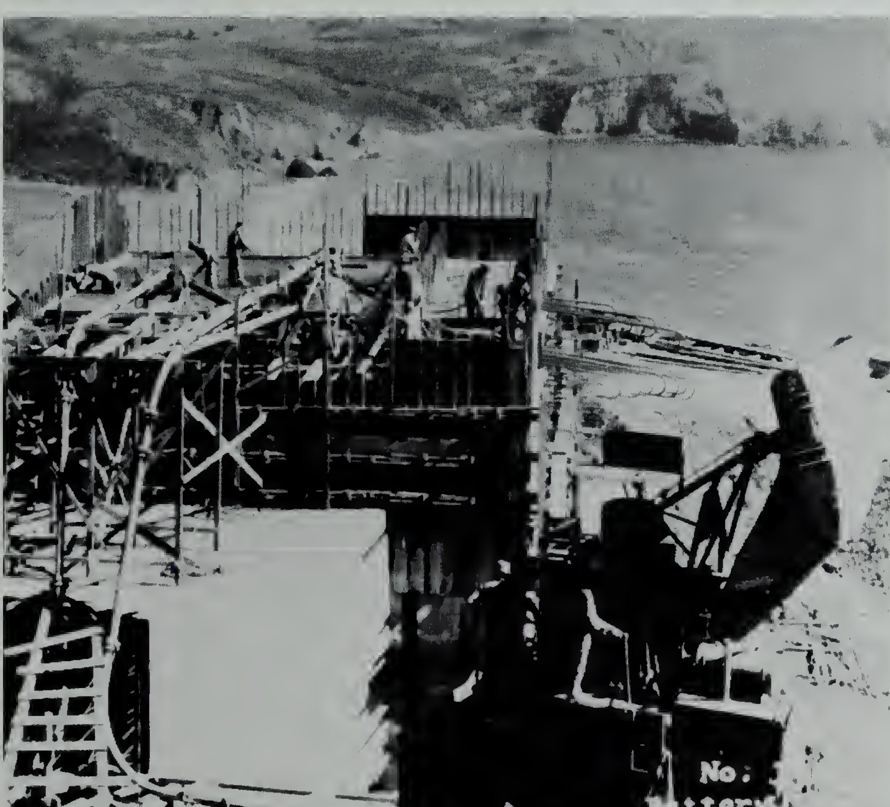
In 1937, the War Department created a third military post on the Golden Gate headlands. Eight hundred acres, north of and adjoining Fort Barry, were acquired by condemnation, and became Fort Cronkhite in December of that same year. It was named to honor Major General Adelbert Cronkhite, a veteran of the Sioux Indian Wars, the Spanish American War, and commander of the 80th Division of the Army Expeditionary Forces during World War I, who died in 1937.



16-inch naval rifle arrives at the Golden Gate – 1937.



Battery Townsley – Fort Cronkhite – August, 1938. Steel beams and trusses in place.



Battery Townsley – September, 1938. Concrete is placed on roof slab.

All during this period, while work was being done on the 16-inch battery at Fort Funston, survey crews were in the field looking for a suitable site for a similar emplacement to be built north of the Golden Gate. It was proposed for various locations — Tennessee Point, Fort Barry and Wolf Ridge. The location chosen was the Tennessee Point tract, a 5.5 acre piece of land that was added to Fort Cronkhite in 1938. Work on the 16-inch tactical twin of Battery Davis was begun in early January, just as the work at Fort Funston was winding down.

The 16-inch gun emplacement on Fort Cronkhite was named Battery Townsley, in honor of Major General Clarence P. Townsley of World War I fame. Using the same basic design employed at Fort Funston, the San Francisco District engineers worked with all deliberate speed to complete the Townsley Battery. Within a year and a half they had the job done and turned the facility over to the coast artillery troops during the summer of 1940.

Interestingly enough, the District was able to secure and place the huge naval rifles for Fort Funston with relative secrecy. Such was not the case for the guns to be placed at Battery Townsley. When the 150-ton tubes for Fort Cronkhite arrived from the Watertown Arsenal during the summer of 1939, their movement from the Sausalito wharf of the North Pacific railroad, to their new home received widespread coverage in the newspapers.

American plans for the harbor defense rested heavily upon the success of these two new 16-inch batteries, built by the San Francisco District prior to our involvement in the war. Thus, the War Department

Reserve magazine for Battery Townsley – January, 1939.

wanted to test the strength of their mounts and support services as soon as possible. So on July 1, 1940, almost a month before Battery Townsley was officially completed and turned over to the using troops, a special pre-completion firing was ordered. On that summer day, the first 16-inch rounds ever fired on the Pacific Coast left the muzzles of Battery Townsley. It was a highly successful experiment, resulting in only minor damage to non-critical cradle and carriage fittings. With the completion of Batteries Davis and Townsley, the harbor at San Francisco could once again claim to be the most heavily fortified position on either coast of the United States. And, until the development of nuclear weapons, the batteries were thought to be virtually impervious to air bombardment and high angle naval gunfire.

Anchor bolts go into place at Battery Townsley – April, 1939.

Large naval rifle on its way to Battery Townsley – July, 1939.

Just weeks following the attack on Pearl Harbor, further testing was done, using the mammoth guns of Fort Cronkhite. According to Angeloni, military experts weren't exactly sure of the penetration power of the 16-inch guns. While their range and accuracy had been proven by shooting at targets towed by ships at sea, only educated guesses could be made of their full power. On the other hand, no one could say with certainty how much concrete and steel was needed to protect American fortifications from similar weapons directed by enemy forces.

To answer both questions, the Corps of Engineers' San Francisco District in the months prior to Pearl Harbor constructed four specially built test blocks. Made of concrete, reinforced with steel, and

Moving the gun from one place to another required patience and careful placement of timbers and rollers.

Soldier stands at the ready next to the huge rifle of Battery Townsley – Fort Cronkhite.

placed 620 feet from the end of the barrel of a 16-inch gun, the four blocks were all 42 feet wide and 27 feet high. Two were 23 feet thick, one was 16 feet thick, and one 13 feet thick. The two smaller blocks had more reinforcing steel in them than the larger ones, for, part of the experiment was designed to see if smaller, more densely girded works would offer the same protection as larger concrete barriers that contained less steel. The concrete used in their construction was designed to have a compression strength of 5,000 pounds per square inch (psi) — 3,000 pounds (psi) is considered average.

Each block was carefully inspected during each phase of construction and each was fitted with a variety of metering devices to ensure accurate measurements when hit by the 16-inch projectile. The

Forms are shown partially complete for the large caliber test – December, 1941.

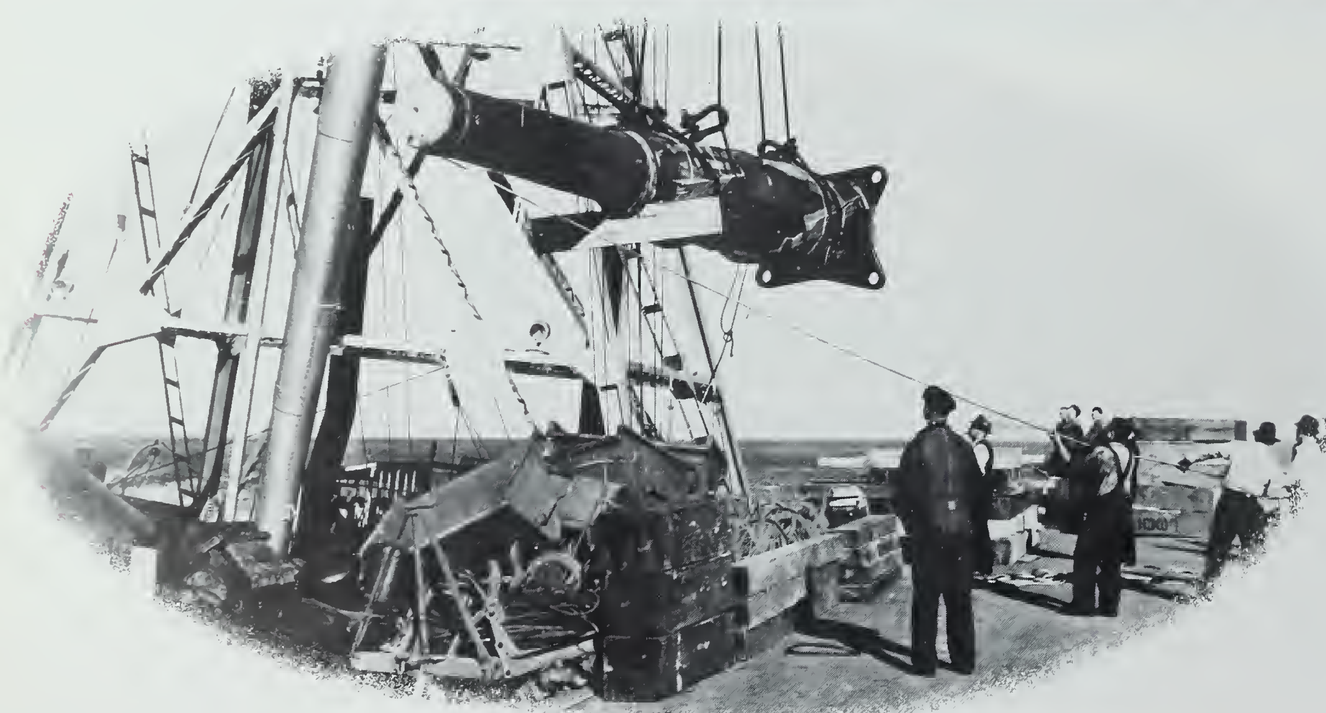
Large caliber projectile test – general view of slabs at time of impact of shot 2 on slab 1 – January 9, 1942.

information gained was to be used for designing bombproof structures.

Rather elaborate preparations were made prior to the actual tests. Distinguished observers — high ranking officers including generals, and important civilians occupied a "pill box" observation point. In addition, special cameras were brought in to film the tests. Penetration was estimated to be eight feet by the experts, but when the big gun was fired, the shot went through the entire 23 feet of concrete. Considerable concern was expressed by those directing the tests, and the strength of the concrete was the first item to be questioned. Subsequent tests proved, however, that the material exceeded the

Large caliber projectile tests. View of crack in recoil cylinder – January 9, 1942.

Unloading 12-inch gun tube from barge to Fort Baker mine wharf – June, 1939.



5,000 pound (psi) specifications, thus proving two things. One that the San Francisco District personnel in charge of construction had done their jobs well, and two, that the 16-inch rifles were more powerful than previously thought.

Several more shots were taken at the blocks and the information analyzed in terms of future construction projects. Finally, when they had served their intended purpose, the blocks were toppled over and buried.

These weren't the only tests conducted during the late 1930s and early 1940s. It will be remembered that Battery Wallace, located on Fort Barry, mounted large 12-inch long-range guns. Built in the

Wolf Ridge interior quarters – March 12, 1942.

Fort Mason – 1942.

early twenties, it was modernized by casemating the guns, and general strengthening of the compound. Corps personnel remembered that the guns of Battery Wallace were frequently test fired prior to World War II. This was done not only to determine the readiness of the guns, but to provide practice for the crews manning the weapons.

In addition to the batteries constructed or modernized on the Bay Area forts, several other non-fortification type installations were built by the San Francisco District prior to the attack on Pearl Harbor. The largest numbers of these were fire control stations which provided extensions to the fire control system then in existence. These stations begun in 1939, ultimately numbered between 60 and 70 separate installations, and were spread along 40 miles of the district's coastline, from Drake's Bay to Half Moon Bay, and westerly to the Farallon Islands. It would be from these, that the batteries would receive vital information should attack come from air or sea.

Besides these, warehouses, barracks, mine handling facilities and other projects were built by the San Francisco District, months, even years, before the Japanese attack on Pearl Harbor.* Clearly, then, while military planners weren't sure when, or if war would come, they nonetheless knew from which quarter it would be launched, should the Japanese find it in their best interest to do so.

On a national level, Congress transferred all construction done for the Army Air Force from the Quartermaster Corps to the Corps of Engineers during November, 1940. Then, on December 16, 1941, all Army construction was transferred to the Corps of Engineers. The first shift in responsibility had a significant impact upon the San Francisco District; for example, new people were hired to carry the additional load, and a Fortifications Division was established in 1941, with John McDougal in charge of design and construction. When all Army construction was assigned to the Corps of Engineers, the effect upon the District was unprecedented. Nothing remained the same — nor would things ever be the same again.

World War II

At 7:58 A.M. on the morning of December 7, 1941, Rear Admiral P.N.L. Bellinger broadcast a short radio message which shook the people of the United States as nothing had since the firing on Fort Sumter:

Air Raid, Pearl Harbor — This Is No Drill

The message was first heard on the mainland by a radio operator at Mare Island Navy Yard. This message, and others being shouted into microphones in and about Pearl Harbor, were picked up

*See Appendix B for typical equipment owned by SPD in June 1941.

by the tall radio towers located on Mare Island, which served as the main transmitting-receiving station for trans-Pacific military communications. At 2:20 p.m. Washington D.C. time, less than an hour since the first wave of enemy planes attacked, White House Press Secretary Steve Early, still at home in his pajamas, got the press services simultaneously on the telephone and released the news. Shortly thereafter, Franklin Roosevelt requested that secretary Grace Tulley come into his study, and began dictating: "Yesterday comma December seven comma nineteen forty-one dash a date which will live in infamy dash."

WAR!

Chronicle Home Carrier Service

San Francisco Chronicle

THE CITY'S ONLY HOME-OWNED NEWSPAPER

COMPARATIVE TEMPERATURES

Local Forecast: Fair

FOUNDED 1865—VOL. CLIII, NO. 146 SAN FRANCISCO, MONDAY, DECEMBER 8, 1941 DAILY 5 CENTS, SUNDAY 10 CENTS

JAPAN ATTACKS U. S.!

25 YEARS AGO TODAY

Hawaii and Manila Bombed;
Chute Troops Off Honolulu!

LLOYD GEORGE ACCEPTS BRITISH PREMIERSHIP . . . CONVICT WALKS OUT AT

The following night, Monday, December 8, the war was brought to the San Francisco District—or at least many people thought it had been! Military and civilian personnel alike thought that they heard enemy planes overhead. Scores of people, all up and down the coast reported seeing flares dropping from the skies. Others were sure that Japanese paratroopers had landed in Golden Gate Park, and men with shotguns and rifles could be seen beating the bushes in attempts to find enemy soldiers.

In response to the enemy bombers over San Francisco, a blackout was ordered by the Army.

Eleanor Roosevelt, flying west at the time received word that San Francisco was being bombed just as they neared the Nashville, Tennessee airport. The plane, in which she was a passenger, landed and Mrs. Roosevelt telephoned San Francisco to learn that the City had not been bombed, but that a blackout had been ordered up and down the coast because enemy planes had been heard from the Army posts.


(Associated Press by Transpacific Telephone)

SAN FRANCISCO, Dec. 7.—President Roosevelt announced this morning that Japanese planes had attacked Manila and Pearl Harbor.

Attack Made On Island's Defense Areas

By UNITED PRESS

WASHINGTON, Dec. 7. —Text of a White

under attack were Wheeler field Hickam field, Kaneohe bay and naval air station and Pearl Harbor.

Some enemy planes were reported short shot down.

The body of the pilot was seen in a plane burning at Wahiawa.

Oahu appeared to be taking calmly after the first uproar of queries.

ANTIAIRCRAFT GUNS IN ACTION

Many San Franciscans, who hadn't heard or seen the enemy, believed that the whole affair was just a drill, and paid little or no attention to the blackout order. They left their lights burning brightly and went about quite as they always had. On these who paid no heed to the Army's orders, Lieutenant General John L. DeWitt, Commanding General of Western Defense Command, poured a deluge of verbal invective that fairly rang from the walls of City Hall.

On the afternoon of Tuesday, December 9, the General met with Mayor Rossi and about 100 civic and defense leaders in the Board of Supervisors Chambers and raked them (and all San Franciscans) with a scathing rebuke for their criminal apathy. He warned the silent, fidgeting audience that death and destruction was likely to come to the City at any moment. Once and for all he buried rumors that the previous night's alert was a test, or worse, a hoax. He stated flatly that

it was idiotic and insane for anyone to assume that he and his fellow officers would pull a hoax of that nature on his fellow citizens.

DeWitt wasn't alone in his feeling, for Rear Admiral John Wills Greenslade, commanding the 12th Naval District, and Major General Jacob E. Fickel, Commandant of the Fourth Army Air Force, endorsed General DeWitt's pronouncements, and declared that Monday night's emergency blackout was fully warranted. According to the Admiral, only the grace of God could be credited with saving everyone from a terrible catastrophe. He said that, if bombs had fallen, the resultant damage would have been unimaginable. General Fickel told the gathering that credible reports had placed aircraft not only over the City, but also near Monterey and Los Angeles.

Then General DeWitt got tough! He told the crowd that the reason he and the other officers were there was because they wanted action, and they wanted it immediately. He predicted that unless specific and stern action was taken to correct the previous evening's deficiencies, a great deal of destruction was inevitable. The general reminded his listeners that Japanese planes were over San Francisco for a considerable period of time. And, while he didn't know why the enemy failed to drop their bombs, he felt it might have been better if they had—at least the City would then be awake to the danger. When asked why his troops didn't shoot, if indeed the planes were Japanese, he snorted that it wasn't any of the questioner's damn business. Wasn't it enough that San Franciscans woke up the next morning without a single death from bombs?

The San Francisco News of Wednesday, December 10, 1941, reported that San Franciscans had been jolted out of their sleep twice on Tuesday night (actually Wednesday morning). The first alarm was sounded at 2 a.m. on the order of the Fourth Interceptor Command, headed by Brigadier General William Ord Ryan. Within minutes, however, the all-clear signal was sounded.

At 2:18 a.m., a complete blackout was ordered when unidentified planes were heard approaching San Francisco. Similar blackouts were ordered throughout all of California, Western Oregon and for the coastal areas of Washington State. This time authorities reported that the procedures went quite well. According to San Francisco newspapers, the improved blackout was the result of a "must" order from General DeWitt. For, only the day before he threatened to have the police knock the facts into people's heads with clubs, if his words failed to move people to appropriate action.

With the perfect hindsight of history, we know, of course, that no Japanese carriers lurked off the coast. Hence there was no immediate danger of attack from the air. On the other hand, what General DeWitt didn't know, nor did any other American know, during those first few days of the war, was that there was indeed a very real danger of attack by enemy submarines.

On December 10, 1941, seven Japanese submarines which had been chasing the *U.S.S. Enterprise,* along with a pair of other I-boats, as Japanese submarines were called, were ordered to our Pacific Coast. Upon arrival they were to take up patrol stations in order to attack

civilian as well as military shipping. Specifically, they were to sink any and all supplies and reinforcements destined for the relief of Pearl Harbor. I-15 took station just west of the Farallon Islands.

On the evening of the 17th, Zenji Orita, executive and torpedo officer of the I-15, looking through his binoculars at the glow given off by the lights of San Francisco, thought that the Americans certainly acted carelessly, in that they allowed coastal shipping to be silhouetted by the lights from the City. The following night, however, there was a blackout in San Francisco, giving Orita and his men the feeling that their presence must have been discovered.

For eight days they watched and waited, but saw nothing and hence made no attacks. Others, however, had better hunting. I-17 and I-21 both claimed sinking two cargo ships each. Commander Genichi Shibata's I-23, stationed off Monterey Harbor, attacked a small patrol boat in full view of spectators on the shore. Besides these kills, the submarines made hits upon other ships which managed to limp away without sinking.

Shortly after the Japanese took up station off the San Francisco District's coast, Vice Admiral Shimizu ordered that they depart for Kwajalein on Christmas Day. First though, all nine submarines were to shell the mainland with every round of 4.7 inch ammunition they had with them. I-15 was to bombard San Francisco. Just hours before they were to train their gun on the City, the order was countermanded by Admiral Osami Nagano. So without even knowing it, the citizens of San Francisco escaped the destruction promised earlier by General DeWitt and his fellow officers. In all likelihood, the enforced blackouts probably saved the lives of many sailors, by not highlighting their vessels for enemy torpedo officers.

While the San Francisco area wasn't the recipient of enemy shelling, oil fields near Santa Barbara located south of the District were. Just after sunset on February 25, 1942, Commander Kozo Nishino, in command of I-17, surfaced his boat in Santa Barbara Channel. Seventeen shells were fired from the deck gun before Nishino ordered the gun crew off the deck, and the boat taken below the surface. As they sped away, American planes dropped flares in a vain search for the vessel. The next day, coastal newspapers carried panic headlines and stories about the shelling of the Elwood oil field, by a Japanese U-Boat.

A few months later, during the pre-dawn hours of September 9, 1942, I-25 came in sight of Cape Blanco lighthouse, some 50 to 60 miles north of the California-Oregon border. On board was a Type 96 submarine scout plane, disassembled into a dozen separate parts, and stored in two hangers. The Type 96 was known as a "Geta" because its floats resembled Japanese footware.

Also on board the I-25 were Warrant Flying Officer Nobuo Fujita and his crew of one, Petty Officer Shoji Okuda. At first light on that September morning, they climbed into their plane and catapulted off the deck of I-25. Their mission was to drop incendiary bombs on the forests of southern Oregon. Japanese military strategists hoped that large forest fires would spread panic on the West Coast, so that an

aroused public would demand a pullback of American ships from mid-Pacific operations, so that they could guard our coasts.

Fujita and Okuda flew due east some 50 miles before they dropped the first of their two bombs. Each weighed 154 pounds, and carried 512 tiny incendiary capsules, that upon impact would burn at 2,000 degrees and set an instant fire some 200 yards in diameter. As the first bomb dropped, it armed itself with its wind-spun propeller. When it hit it burst into flame immediately and did in fact set off a forest fire.

They flew on for about another 15 miles, dropped the second bomb and then returned west over Cape Blanco to find their ship. As they did, they spotted a pair of American merchant ships heading north, a few miles apart. Flying only inches above the water, Fujita passed between them, and hoped that neither would recognize him for what he was. The "Geta" was barely secured in her hanger when an American plane appeared without being seen by the lookouts, and dropped two bombs, missing the I-25, but forcing her to crash dive and lay at 250 feet below the surface. Throughout the day American forces dropped depth charges in the area, but none caused any damage.

Following successful attacks on coastal shipping along the coast of Washington and British Columbia, Commander Meiji Tagami, Captain of I-25, headed south toward Cape Mendocino where he planned to send Fujita over California's redwood forests. Because of rough seas, however, that operation was cancelled and the I-25 headed north again to take station off Cape Blanco. And it was from there, during the night of September 29, 1942, that Fujita and Okuda made history once again; they being the only enemy airmen to bomb the United States.

After dropping two more fire bombs on southern Oregon, they rendezvoused with the submarine and continued cruising off the San Francisco District's coast, looking for shipping targets and a suitable place from which to launch a third raid upon the mainland. On October 5, Tagami sank the 7,038-ton tanker SS Larry Doheny, between San Francisco and Seattle. The following day he hit another ship, but she was able to get to port. On the tenth of October I-25 torpedoed and sank the 6,653-ton SS Camden off Seattle. With only one torpedo left and the Americans alerted to another possible fire-bombing raid, Tagami headed west for home waters. Just the next day however, he spotted a pair of submarines running on the surface west of Seattle. He fired his last torpedo at them and sank one of them — a Russian sub on her way supposedly to Puget Sound.

So ended Tagami's second voyage to our West Coast. On his first visit, in company with the eight others who took station there only three days after Pearl Harbor, he chased a large merchantman into the Columbia River where it ran aground. Before the war's end, Tagami would be back hunting along San Francisco District's rugged coastline.

It is not known for certain if territory included within the San Francisco District was actually bombed by Fujita and Okuda. Fujita

District Engineer 1942-1944
Col. James D. Andrews, Jr.

reported dropping his first bomb some 50 miles due east of Cape Blanco, and then flying about ten minutes more before dropping the second. Depending upon the accuracy of his calculations, the second bomb was dropped near the headwaters of the Klamath River near Upper Klamath Lake. This is also very close to the demarcation line that separates the Portland and San Francisco Districts. Thus it is possible that a Japanese plane actually did bomb San Fancisco District territory. Regardless of locations, the shelling of the coast, the sinking of American shipping, and the fire bombings in southern Oregon, when placed in the general matrix of the terrible and successful attacks upon our Pacific bases by the Japanese, did result in engendering deep concern in all, fear in many, and absolute panic in a few of the residents of the San Francisco District.

The impact on the District office was immediate, conspicuous and striking. Corps of Engineers officers, who had traditionally come to work in civilian attire, now arrived in uniform. Vacations and holidays were cancelled and the work week extended from 39 hours to 40 and then 48 hours. This was only official policy. In reality, District employees, during the war years, often worked 12 to 16 hours a day, seven days a week. For long periods of time it seemed the only constraint upon hours of employment was one's physical endurance.

The whole office appearance was also changed and assumed a military character. Many civilian employees were given overnight commissions and soon appeared back at their desks in uniform. And with the tremendous expansion of personnel, military officers either fresh from training facilities, or transferred from other posts reported for duty with the San Francisco District. This was especially true of officers from the Quartermaster Corps who were transferred to the Corps of Engineers when the construction functions of that branch were turned over to the Corps of Engineers.

The coming of war changed the look of the office and modified routine duties of the civilian work force as well. The sheer numbers of people working for the District either directly, or as hired labor, went from hundreds before Pearl Harbor to thousands shortly thereafter. Many of these were Corps employees who had previously worked on navigation and flood control projects and were now building defense installations. Others were new people, secured whenever and from wherever possible, often, as was said during those hectic days, from the bottom of the barrel and occasionally from under it!

Recruiting, assigning and transferring personnel placed extremely heavy demands upon the District's Personnel Branch. Of these separate functions, recruiting was probably the most challenging — especially during the early months of the war. For, not only did the San Francisco District have to compete with her sister districts for manpower, but also had to compete with other government and civilian construction agencies. This was especially true regarding the ship building industry. Soon after the declaration of war, the largest concentration of shipyard workers in the nation was in the San Francisco Bay Area.

Under the able direction of Evelyn Norman, the District

Personnel Office answered the manifold challenges of this hectic period, and was able to maintain accurate and up-to-date records for the incredible numbers of people involved. A major problem that frequently occurred was that of actually getting a new recruit on the job. As often happened, a potential employee, after agreeing to sign on with the Corps and while on the way to an assigned position, would be intercepted by a competitor, offered greater inducements and lured away to another job. So even though the San Francisco District sought and found men and women from far afield, it was no guarantee that the new converts would show up where expected. Finally, since deferments from military service were not necessarily given to industrial workers at that time, the Selective Service program took a share of the limited labor pool and caused additional work for Mrs. Norman and her crew.

A variety of government actions were taken early on to try to bring sense and stability to the recruitment and deployment of defense workers. On March 16, 1942, Civil Service regulations permitted the Personnel Branch to make "War-Service" appointments, which assured employment for the duration of the war plus six months. The following month, the War Manpower Commission (WMC) was created to control manpower distribution, and by early fall of 1942, the WMC had submitted a plan to halt the unnecessary migration of personnel within industry. While these tended to achieve the desired effect, President Franklin D. Roosevelt's executive order freezing wages at prevailing rates set by the Department of Labor, issued in October, 1942, actually had a negative impact in many respects. This was so because it impeded the filling of positions at contract projects in the hinterlands, where wages were traditionally lower than in the urban areas.

Despite the efforts to solve the problems associated with recruitment and deployment of personnel relative to the war effort, a great many difficulties persisted throughout the war period. Even so, each was sorted out, put into perspective and dealt with by San Francisco District's Personnel Branch.

Other areas of District Office activity, significantly affected by the onslaught of wartime pressures, were cost and property accounting. During this period, outlying Area Offices maintained decentralized cost accounts. These included costs for maintenance and operations, in addition to those related to the military and civil work being accomplished. Once approved by the senior engineer, records were forwarded to the District Office, where they received appropriate attention and then were filed. The sheer numbers of these made coordination and maintenance of records a challenging profession, for they had to be readily available for review and inspection by District and Division auditors, the Army Audit Agency, the Office of the Inspector General and the General Accounting Office. With every inspection came the inevitable questions and exceptions, which required answers, follow-up reports and occasionally corrective action. Hence, the accounting for funds and the proper maintenance of records for each and every project—whether government or

private — always a demanding task, was made more so because of wartime projects.

Closely associated with this function was the job of property accounting. The wartime projects of the San Francisco District, especially those carried out by hired labor, made this a particularly exacting job. Every item had to be marked, inventoried and accounted for. With so very many projects under way, handled by so many different individuals — often not accustomed to government procedures — patience and perseverance were the order of the day. Once in awhile, "creative accounting" procedures were needed.

Such was the case when auditors arrived unexpectedly at the District's Shops and Yards base, located then near the Marina Boulevard Gate entrance to the Presidio. During the inspection, it was discovered that, "one, each, boat, row, 14-foot, grey, complete with oars (2) and oarlocks" was missing. The Yards and Shops men knew that the vessel in question had been in for repair and that it had been returned to a survey crew. Someone apparently had neglected to complete the required accountability forms prior to putting the boat back into service.

Fortunately the loss was noticed before the noontime lunch break. The men in charge promised to conduct another search and have the boat ready for inspection by the afternoon. Upon the departure of the auditor, the carpenter went right to work. When the auditor returned from his lunch break, he was escorted to the harbor. There he saw floating in the water, a 14-foot, grey rowboat, complete with oars and oarlocks. Later, the original was found, the paperwork straightened out and things set in order.

This humorous little example simply reflects the degree to which San Francisco District personnel were held accountable for government property in their charge. It is also illustrative of the thousands of other pieces of equipment, large and small, situated throughout the district, on which accurate, up-to-date records had to be maintained.

The greatly expanded activities, and the attendant problems, associated with personnel and accounting were more than matched by those of procurement and supply. Prior to the war, especially during the 1920s and 1930s, the San Francisco District supply system supported an expanding civil works program and a relatively small military effort. In the main these included buying subsistence and operating materials for hopper dredges working in the District's harbors, for the hydraulic dredges working on Treasure Island, for materials needed to build and repair jetties, for the purchasing of housekeeping supplies for the District Office, and for the specialized equipment to support the fortification work being completed. Supply, for the most part, was simple, direct, and done upon demand as needs arose. Purchasing was done either through Treasury Procurement contracts, Navy contracts, or if under $1,000, on the open market. For the purchase of items exceeding that amount, formal bids were required. With the conditions manifested by World War II, however, this simple system had to be modified to satisfy the unprecedented

demands of national survival.

Military planners charged with supply were not caught totally unaware by Hitler's blitzkrieg and Japan's sneak attack. For, during the depression years plans were made to create six procurement districts (New York, Philadelphia, Pittsburgh, Mobile, Chicago and San Francisco) that would function separately from civil works districts of the Engineer Department should war again break out. The startling realities of the Second World War, however, dictated that these pre-war plans be modified. As it turned out, District Engineers would assume responsibility of procurement districts.

San Francisco District's responsibilities for supply increased during the months just prior to American involvement in the war, and paralleled those of the Army generally. From the beginning of the mobilization program, it was recognized by the Federal Government national administration that rigid control of production and distribution would be necessary. The initial step towards that end was the establishment of a priorities system during the first months of 1941. This meant that, from that point on, agencies involved with defense production were to be given preference in obtaining essential materials. While the priority system was better than no plan at all, and did in fact have a positive effect, it failed to reach into the sources of such basic raw materials as copper, steel, and aluminum, and thus did not pro-rate the diminishing stock of these materials to the various using agencies.

By late spring 1941, requirements of our war production program began to out-strip the production of critical metals. And as spring turned to summer, the procurement of these became progressively more difficult relative to the manufacture of refrigeration units and other types of specialized equipment. Besides the shortage of essential elements, the fact that the Division Engineer's approval was required for the purchase of construction plant and equipment also tended to slow the entire process. This part of the system would change quickly after December 7, 1941.

During January, 1942, directives were issued which permitted the District Engineer to secure materials and equipment on the open market. Fortunately this came at about the same time that Districts, including San Francisco, were absorbing the vast responsibilities connected with their expanded role in military construction. This was followed in March by allowing Districts to by-pass the formal bidding process, so that needed work could get underway immediately. Just the next month, the services were freed of the obligation to fix a final price at the time contracts were signed. The vital thing was to get things done in the interest of prosecuting the war; details would be settled later, when more was known about overall costs and profits.

It hardly needs repeating that the summer and fall of 1942 were extremely critical periods for the procurement branch. Not only were San Francisco District and the other Districts scrambling for materials, but so were all other war production agencies buying materials for a rapidly expanding construction effort. It got to the point rather quickly, that even the purchase of standard items from dealer's stocks

was almost impossible.

The Corps of Engineers on January 1, 1943 endeavored to satisfy the demand by increasing the number of procurement officers from six to ten, all of which were directly responsible to the procurement branch of the Office, Chief of Engineers (OCE) in Washington, D.C. San Francisco District continued as one of these offices. With this increased responsibility the supply activities of the District soon grew to the point where the numbers of personnel could no longer be housed in their quarters at 74 New Montgomery Street (offices to which they had moved only months before from the Customs House). To alleviate this condition, additional offices were rented in the building just across the street from the District Office. While the expanded accommodations went a ways toward solving the problem of space, it did not completely alleviate all the problems associated with supply.

In large measure a solution was found in the Controlled Materials Plan program, initiated on April 1, 1943. With the implementation of this plan, steel, copper and aluminum were divided throughout the war-production program, and a system established to control material from source to finished product. From that point on, materials were distributed more evenly, and coordinated procurement with production, controlled by known estimates.

By the fall of 1943, commodity purchase procedures had been decentralized from the Chief of Engineers office to the various Division Engineer offices, with each Division specifically assigned certain commodities. The Pacific Division, of which San Francisco District was a part, was given responsibility for the procurement of asphalt, lumber and plywood for shipment west of the Rocky Mountains. Then, on September 1, 1944, the Chief of Engineers again reorganized procurement functions. Henceforth, all major items were designated for commodity purchase by one of the eleven Division Engineers, with District Engineers responsible for the actual packing and shipping. This procedural shift was accompanied by one designed to control purchasing and stockpiling excess materials. From then on, all requisitions were funneled by the Procurement Branch through an Excess Materials Screening Section, where requested items were compared with excess material lists published periodically by other Engineer Districts and Divisions. In this section each employee was a specialist in a definite category; one person handled requests for electrical equipment, while another coordinated hardware, and so on, covering a wide range of available supplies. By implementing this procedure, items were transferred individually, or in carload lots from storage depots to areas of need, and thus didn't become lost in the shuffle to the war production effort.

Throughout the war years, a key factor in the ability of San Francisco District to meet and exceed its mission, rested with the capabilities of its employees. Each in turn — buyers, inspectors, property and record clerks, typists and warehousemen — did what was required, and often more. Whatever the item, it was indexed as being ready-made, being manufactured, in storage, in transit, or, best of all,

on the job. Moreover, as our involvement deepened, and the United States made a total commitment to stop the aggressors, San Francisco District's procurement and supply mission developed in a fashion that demanded specialized facilities and requisite skills far beyond those required for securing and distributing goods previously. Seemingly at once, there was a need for thousands of different line items, each in its own way vital to the war effort.

Under wartime conditions, San Francisco District's supply personnel entered the construction picture from the day a design was begun. Often, in fact, procurement and engineering progressed simultaneously. And, once standardization in design was established for various utilities and facilities, procurement sometimes moved ahead of design so that needed materials could be found and stockpiled even before the final design for a specific project was finished. This was because, even though no two projects were exactly alike in every detail, many, such as airfields, sewage and water supply systems, electrical systems, housing and warehouses, all required many of the same component parts, even when located hundreds of miles apart.

The materials and equipment purchased had to be inspected for compliance with specification, either during manufacture or upon arrival at the receiving point. Goods purchased at plants outside the San Francisco District were generally inspected through arrangements made with the District Engineer in whose territory the purchase was made. Similarly, a reciprocal agreement was made with San Francisco District personnel to inspect and approve materials purchased within our District by other Corps of Engineers' Districts.

An example of one of the first wartime missions completed by the procurement and supply people of the District was that of securing goods for the Honolulu District. For, Americans were expecting, and in fact the Japanese were planning, still another raid on the Hawaiian Islands. On December 15, just eight days following the attack on Pearl Harbor, the Honolulu District requested 100,000 burlap sacks (to be used for sand bagging defensive positions). Interestingly enough, these were produced in the San Quentin Prison Jute Mill by prison volunteers, in short order, and shipped to the islands. These were soon followed by paint, lumber, other building supplies, tractors, scrapers, trucks and a variety of farm equipment.

In addition to the fears of further bombings and invasion, was added the real concern that the islands may be blockaded — as were the Philippines — resulting in a shortage of food. A plan, therefore, was quickly formulated to plow up the pineapple fields so that vegetables could be planted. It was recognized, however, that if these were not grown within some four months, food would be in short supply. To guard against such an eventuality, San Francisco District's Supply Division located 300 tons of seeds, including beans, cabbage, tomatoes and carrots. Of this, 100 tons were air-freighted, and the balance sent by ship. In addition, thousands of cases of canned goods were sent to the islands via transports, which, by that time, were leaving San Francisco Bay each day.

Accounting, procurement and supply, and all of the critical functions necessary for the prosecution of a total war effort were carried on by the San Francisco District, both within its San Francisco headquarters and in the many field offices situated over the entire District. And, while they are essential, these processes are usually hidden from the public eye. It was the fortifications, the camps, and the airfields that caught public notice, and were the physical manifestations that caught people's attention, and let them know that they were indeed at war.

Something else gained the attention of citizens on the West Coast as well. This was the suspected "enemy within." When the Japanese struck Pearl Harbor, it caused an immediate gut impulse for revenge. Within the brief span of weeks, this knee-jerk reaction would account for one of the first "rush job" construction efforts undertaken by the San Francisco District.

The day after Pearl Harbor, funds belonging to Japanese-Americans living in California were frozen and banks refused to cash checks bearing Japanese names. They had great difficulty in buying food, clothes and other essentials. Milkmen would no longer deliver to them, insurance companies canceled their policies, and citizens forbade them to conduct business. In many cases they were even forbidden to put out to sea as commercial fishermen.

Even though the Japanese-Americans represented but one percent of California's population and only one-tenth of one percent of the population nationally, they looked rather exactly like the enemy, which, for many Americans, meant that they might be, and probably were, the enemy. For these it mattered little that the majority of those of Japanese ancestry were American citizens.

Pushed by newspaper publishers, agricultural interests, legislators and a great variety of other white-dominated interests, Franklin D. Roosevelt on February 19, 1942, signed Executive Order No. 9066, authorizing the Secretary of War to establish military areas and to exclude from them any or all persons. The order for exclusion was put in force immediately. Within days 110,000 people — the entire Japanese community of the West — were rounded up and removed from their homes.

Much, perhaps more than is needed, has been said about the reasons for this action, and the blame Americans must sustain forever more because the action was taken. It is certainly not a function of this brief history to analyze it further, or endeavor to explain it. It is a fact, however, that because it was taken, the San Francisco District was required to play a role in the relocation of the Japanese-Americans. It is also a fact that the shock and terror that followed in the wake of the sneak attack on Pearl Harbor caused the majority of Americans to honestly believe they were in mortal peril of invasion.

The first step was the building of temporary assembly centers, wherein the Japanese could be housed until more permanent structures — Relocation Centers — could be constructed. Typical of the 15 West Coast assembly centers was Tanforan Race Track, converted by the San Francisco District to hold thousands of Japanese-Americans. So

quickly was the job done, that when a Corps officer appeared in the District Office with a request for 400 paychecks for the carpenters involved, the office personnel responsible for drawing the warrants pleaded ignorance to the whole project. The race track conversion job required the 400 men employed only four days to complete!

At about the same time, the San Francisco District Engineer was ordered to acquire real property for the Northern California Relocation Center, which was to be built near Tule Lake, located just south of the California-Oregon border. Shortly thereafter, standards and details for all of the centers were developed and adopted jointly by the Commanding General of the Western Defense Command and representatives of the Chief of Engineers. Following this, plans and specificaitons for the Tule Lake Center were prepared by the San Francisco District. Actual construction of the center was done by civilian contract, under the supervision of the District. In all, ten large relocation centers were built, all on federally-owned land, usually Indian reservations, and run by the War Relocation Authority, created to take over Japanese internment from the Army.

Over four years, these relocation centers were the scenes of 2,120 marriages, 5,981 births and 1,862 deaths from old age. Some of the Japanese remained in the camps for the duration of the war, while others were resettled, usually in the Midwest as early as the first months of 1943. At war's end, all of the camps were closed. The remaining internees left these isolated centers and returned as best they could to their pre-war life. For San Francisco District, the construction effort involved was minor when viewed against a backdrop of its total work load. Nonetheless, it was significant in terms of the humaneness with which it was carried out.

During World War II San Francisco Bay became the major staging area for men and materiel going to the Pacific Theater.

The really large projects were those designed on the one hand to prevent invasion, and on the other to ready our forces to crush the aggressors. These included fortifications, training camps, airfields, rail yards, port facilities, housing, arsenals, hospital wards and a variety of other projects demanding skilled engineers.

Fortification work, which had always been a function of the District, intensified when the shooting started. Batteries, the largest of which were Townsley and Davis, were upgraded and expanded. New artillery defenses, including observation stations, ranged from Pescadero on the south to Drakes Bay on the north. Anti-aircraft gun batteries were constructed at Lands End, the extreme westerly portion of Golden Gate Park, on the Presidio Grounds and on the Olympic Club property at the southerly end of Lake Merced. Still others were installed on Alcatraz Island, on Point Bonita within the Fort Barry reservation, on a high ridge west of Santa Fe Channel near Richmond Harbor, at Emeryville and Alameda, and at Battery Cavallo near Fort Baker landing.

To support and augment the coastal and anti-aircraft batteries, the San Francisco District, with hired labor, built radar installations, fire control stations, orientation markers, searchlight facilities and a variety of observation platforms. One such facility was even built at the Golden Gate Bridge toll plaza to observe ships entering and leaving the harbor.

Guns are placed near the toll plaza of the Golden Gate Bridge.

The largest construction job completed in the Bay Area by the San Francisco District was the Oakland Army Base and general supply depot. Begun by the Quartermasters, this facility was one of the "from the ground up" jobs taken over by the Corps of Engineers. Even before our active participation in the war, San Francisco District was dredging about the area in support of the Quartermasters' efforts. Before long, however, San Francisco District personnel were busy completing warehouses, loading facilities, and specialized storage buildings. One of the largest projects completed on the base was the laying of railroad tracks and switching units for the movement of equipment.

This project and others were transferred from the Quartermasters during January 1942, and placed under the supervision of the San Francisco District's Construction Division, headed up by Jack Tavelle. Project design work was performed by the engineers on the District staff and supplemented by Architect-Engineer (A-E) contracts. Inspection of A-E work was done by the Engineering Division, while field inspection of construction work was carried out by the Construction Division. Thus, it was by a team approach that the District's war-construction program was prosecuted. Moreover, the assumption of Quartermaster projects by the District caused the doubling and re-doubling of the District's staff. Finally, when the transfer of responsibilities was completed, and new

Troop housing – Presidio of Monterey – January, 1942.

New facilities at Fort Ord – January, 1942.

Storage facilities – Fort Ord – January, 1942.

Officer's mess, Fort Ord – April, 1942.

maps drawn, San Francisco District military construction boundaries included the coastal areas of Northern and Central California, and large portions of the States of Nevada and Utah.

Probably the largest of the construction projects undertaken by the San Francisco District was that of enlarging Fort Ord, located near Salinas. For it was there that every conceivable type of construction was accomplished. Runways, water supply systems, sewage lines and treatment plants, barracks, troop-training facilities, hospital wards, chapels, electrical systems, refrigeration units, storage supply and ammunition dumps, fuel delivery systems, and everything else needed to house, train, care for, feed, and process thousands of troops at one time were built under the design and supervision of the San Francisco District.

A pair of large new troop training camps were constructed by the District between King City and Paso Robles. Located west of Highway 101 in the rolling foothills of the Santa Lucia Range, along the banks of the San Antonio and Nacimiento Rivers, are Camp Roberts and the Hunter Liggett Military Reservation.

Camp Roberts, California. Job No. Camp Roberts 42-1, East garrison oil stabilized training area looking southwest from northwest corner of area. May 28, 1942.

Camp Roberts, California. Job No. Camp Roberts 1-3, West end barracks group looking southwest from 5th & J St. May 28, 1942.

Camp Roberts, a 37,000-acre facility, was built as a troop replacement center. Prior to the war the huge tract was known as Rancho Nacimiento. With the need for training facilities, the land was leased by the Army for $125,000 a year from the owners.

Hunter Liggett Reservation was obtained from the William Randolph Hearst estate in late 1940, and consists of about 175,000 acres. On this expansive base, almost every potential combat condition could be created so as to give new recruits a taste of what they would face in real combat. Infantry, artillery and tank troops all received extensive training on this immense government reservation.

Where once the padres of Missions San Antonio and San Miguel worked with the native Indians, raised crops and tended their herds and blocks, tanks, field pieces and marching soldiers swarmed over the landscape, utilizing support facilities constructed by the District.

Once trained, the soldiers would leave for overseas duty via such troop concentration/embarkation facilities as Camp Stoneman, built by the District near Pittsburg, at the confluence of the Sacramento and San Joaquin Rivers. Once on station, they would utilize the tanks, guns, trucks and ammunition stored and supplied from Benicia Arsenal, one of the oldest Army posts on the West Coast. This arsenal, like so many other Army support bases, was also modernized and expanded by the District during the first years of the war.

Yet another monumental task assumed by the Corps of Engineers during this period was that of airfield construction. Here too, San Francisco District played a major role. Training and auxiliary fields were constructed near the communities of Half Moon Bay, Napa, Hayward, Salinas, Watsonville, Monterey, Santa Rosa, Crescent City, Eureka, Ukiah, and Yreka — literally from one end of the District to the other. In addition large construction efforts and runway extensions were completed at Hamilton Army Air Base near San Rafael, and the construction of Parks Airfield near Pleasanton.

Similarly, runway extensions were completed at San Francisco and Oakland airports. On the Presidio, besides the barracks, hospital wards and warehouses, significant improvements were made to the small, but important, Crissy field. Closely associated with this work was the construction of a railroad holding yard near the tiny airstrip.

Besides these Army Air Force facilities within California, San Francisco also prosecuted major contruction efforts at the airfields located near Reno and Las Vegas in Nevada and at Ogden in Utah.

While the major efforts of the District during these years consisted of construction projects designed to, on the one hand, take the war to the enemy and , on the other, stop him should an invasion attempt be made, there was a third, and important, element to be considered: passive defense works. Primarily this meant camouflage. Blackouts were effective in hiding our important cities and defense installations at night, but made no difference during daylight hours.

Camouflaging expansive airfields, large defense plants and sprawling factories was no mean undertaking. On the contrary, it demanded considerable imagination, intelligence and much hard work.

Opposite page:
22,000 troops were transferred from Fort Lewis, Wash. to Hunter Liggett Reservation. Here, the first troops of this huge transfer cross the Golden Gate Bridge.

A prime ingredient in the recipe of artificial concealment was wire fencing material commonly used to keep chickens in a desired place. On to it and into it, were woven and glued chicken feathers, burlap and a variety of other rather everyday materials. It was once thought that the Corps of Engineers, soon after the attack on Pearl Harbor, secured options on every chicken feather in the Western United States. Airfields, factories, water towers, oil storage depots, ammunition dumps — even the San Francisco Mint received the "chicken feather" treatment.

It would be difficult to overstate the contributions made during the war years by the Corps of Engineers generally, and by the San Francisco District specifically. Because, before we could realize our massive military potential, we first had to build the manifold complex of training camps, defense plants, airfields, hospitals and supply depots vital for the prosecution of modern warfare. Moreover, San Francisco District had the additional burdens of coastal defense and harbor development with which to contend. As part of the Corps' $15.6 billion Army construction effort, the District helped set the pace for mobilization that laid the foundation for victory.

The Corps of Engineers, through its component divisions and districts, was able to accomplish the huge tasks assigned, largely because of the experience gained in civil works programs during the two decades between the world wars.

When war broke out in Europe, causing the United States to embark on its first large-scale peacetime mobilization, the Constructing Quartermaster was quickly overloaded by the demands of the unprecedented scale of military construction programs. Because of its existing organization and vast construction experience, the Corps of Engineers by January 1942, inherited complete responsibility for all military construction. At the same time, the Constructing Quartermaster organization was fully assimilated by the Army Engineers.

District Engineer 1946-1947
Col. George Mayo

Upon completion of transfer, the various divisions and districts, including San Francisco, brought to bear the excellent management and design procedures of their civil works and fortification organization. A prime example of this was the cost-accounting system — the oldest and probably the best in the federal government.

It was obvious to military and political authorities alike that construction would be the controlling factor in mobilization process. To meet the new goals the Corps doubled, re-doubled and re-doubled again its efforts. Eventually the total construction program included more than 27,000 projects and cost in excess of $15 billion. Among its major features were camps and cantonments to house and train 5.3 million troops; plants to mass-produce explosives, ammunition, tanks and planes; hospitals providing nearly half a million beds; a huge network of ports and depots; improvements to principal waterways and flood protection for vital industries; bomber bases, flight training schools, emergency air fields and fighter bases.

During the war the personnel strength of the Corps of Engineers reached 700,000 officers and enlisted men, the majority of

which saw action in foreign theaters. In some areas of the Pacific, there were often more Engineers than Infantrymen, or any other arm of the service. Thus, it is not difficult to understand why the Second World War has been labeled an "Engineers' War."

Listed above are but a few of the examples of the kinds of projects completed by the San Francisco District and her sister districts during this period of national emergency. Taken for granted are the harbor projects of the District — maintenance dredging and the like — that were done in support of its large construction efforts. Taken for granted as well, were the flood control and drainage projects completed in relation to camp and airfield development. That which is not, and must never be taken for granted, is the devotion to duty, perseverance, and quality of effort brought to tasks, whether in the office, field or trenches, by San Francisco District personnel and their sisters and brothers across the nation and around the globe.

Korea and The Cold War

Following the capitulation of Japan the efforts of the San Francisco District turned, in the main, to civil works projects. Two exceptions to this general trend, however, were the areas of contract termination and real estate.

During the war years the complement of District staff had grown to some 1400 employees. With the war's end, however, there were a series of reductions-in-force (RIF) implemented to reduce the personnel to a force believed adequate to handle the estimated peacetime work load. One group that was not reduced, right away at least, was the Contract Termination unit.

To avoid liability for breach of contract, the War Department, since September, 1941, had included a termination article in its contracts. Prior to the fall of Berlin, however, relatively few contracts were terminated by the District. But as the war began to wind down and finally came to an abrupt end with the atomic bombing of Japan, many defense items were no longer needed and thus contract termination became an active field. On the West Coast, termination teams functioned at Seattle, San Francisco and Los Angeles.

This work in the San Francisco District was done under the supervision of James B. Shaw, chief of the Legal Branch. In that millions of dollars were at stake and hundreds of jobs on the line, contract termination was necessarily exacting work and called for people of uncommon skill who possessed keen business minds coupled with diplomatic personalities. Within the San Francisco District a team of more than two dozen investigators, auditors and negotiators worked for the better part of two years to substantiate

claims and negotiate equitable settlements. Apparently, the contractors involved felt the settlements reached were fair, in that few appealed the decisions of the District to higher authority.

Another major priority of the district during the months following the war's end was the dismantling of bases and the disposal of sites no longer essential to our military program. To handle this work, a Real Estate Division was established within the District, under the leadership of Harlan Watkins. The new office had jurisdiction over the area within the military boundaries of the District. Effective January 1, 1947, this included the following California counties:

Del Norte	Solano
Siskiyou	Contra Costa
Humboldt	Alameda
Trinity	San Francisco
Mendocino	San Mateo
Lake	Santa Clara
Sonoma	Santa Cruz
Napa	San Benito
Marin	Monterey

Military construction activities at Fairfield-Suisun Army Airbase (Travis AFB) remained under the jurisdiction of the Sacramento District until completion of work under the then-existing directives. It was planned at the time to transfer authority for this base to San Francisco District as soon as the projects were finished.

Real Estate functions, in the main, consisted of returning leased land, and some of that actually purchased during the war, back to private interests. In addition, grazing permits and similar documents were issued to ranchers and farmers to allow livestock to roam and crops to be planted on land that until recently saw tanks, field pieces and troops maneuvering. Barracks, chapels, storage facilities and other buildings were marked surplus and sold to individuals and private groups for civilian use in order to clean the land that was being returned to the private domain. In other cases, the District's real estate unit purchased property that had earlier been leased and obtained new leases and easements for expansion of existing bases.

By the end of 1947, all remaining military missions of the Sacramento District, with the exception of Travis Air Force Base and the Underground Explosion Tests being conducted in Utah, were transferred to San Francisco District. The new additional areas included 26 northern and central California counties, all of the State of Nevada, less Lincoln and Clark counties, and the entire State of Utah.

Then, on June 21, 1950, just days before the beginning of the Korean War, the Honolulu District Office was designated the Honolulu Area Office and was put under the supervision of the San Francisco District. The Area included not only the Hawaiian Islands, but the Gilbert and Marshall Islands, as well as Johnson, Wake and Midway Islands. Under this new authority, the San Francisco District Engineer assumed responsibility for all activities except for real estate matters.

Effective June 30, 1950, the Western Ocean Division, with headquarters at Sausalito, California, was abolished and its duties and functions reassigned to the Division Engineer, South Pacific Division. Subsequently, by direction of the South Pacific Division Engineer, all remaining operational and service functions of the Western Ocean Division were absorbed by the San Francisco District.

Additional responsibility was given to the District on August 15, 1950, when the functions and responsibilities of the San Francisco Procurement Office (until then under the jurisdiction of the Chief of Engineers) were transferred to the San Francisco District. This action was considered advantageous and necessary in view of the expanded military overseas procurement and supply program.

Due to the large construction program in the state of Utah (because of the Korean War), a Salt Lake Area Office was established on December 19, 1950, for the express purpose of supervising construction at Dugway Proving Ground and , subsequently, at Deseret Chemical Depot, Tooele Ordnance Depot, Hill Air Force Base and Utah General Depot.

Finally, because the military work load of the District was of such huge proportions due to the Korean situation, it was deemed appropriate to transfer some responsibility back to Sacramento District. Accordingly, on January 25, 1951, military construction work (except associated real estate activity) in northern California was transferred to Sacramento District. Included in this assignment were such major bases and depots as Travis AFB., McClellan AFB., Mather AFB., Sharpe General Depot, Sierra Ordnance Depot and the Sacramento Signal Depot. Thus on the eve of the North Korean invasion of South Korea during the summer of 1950, San Francisco District's military mission covered an area that reached from the Rocky Mountains to the Central Pacific Ocean.

From the end of World War II to the outbreak of the Korean conflict the San Francisco District had been reduced to its lowest numbered personnel operational level since its expansion to meet the needs of the Second World War. Each organizational unit had been drained of most of its experienced personnel by a series of reductions-in-force (RIF), until by mid-1950, there was but a total of 322 graded personnel, including field forces. With those as the foundation, the District grew to the point where, within a year, it was in the midst of the largest program in its entire history — surpassing any year of World War II.

Recognizing that existing office space at 74 New Montgomery Street would prove inadequate for the new personnel to be hired, one of the first things to happen, because of our involvement in Korea, was the movement of the District Office to new quarters (36,000 sq. ft.) at 180 New Montgomery Street, where Corps personnel occupied the fourth and fifth floors. Soon, however, even these became crowded, so that additional space (19,000 sq. ft.) was rented on the sixth floor of the same building. Finally, more offices were secured at 1 Powell Street to provide work space for the Supply and Procurement Division.

Below is a table that reflects the dramatic growth in San Francisco District staff during the first fifteen months of the conflict, and gives some indication of the vast scope of the additional programs and increased work load of the San Francisco District in support of American military objectives.

Month	June	Sept.	Dec.	Mar.	June	Sept.
Year	1950	1950	1950	1951	1951	1951
Staff	322	612	709	863	1037	1136

Just as was the case in World War II, a major problem, especially during the first months of the Korean War, was the recruitment of qualified civilian personnel. Situated as it was (and is) in the City of San Francisco, the District Office was located in a highly competitive labor market area, with a large number of governmental agencies as well as a great many industrial concerns requiring the services of, and competing for, those workers in the occupational categories needed by the Corps of Engineers. The task was made doubly difficult due to the fact that field offices were located in isolated areas where housing, transportaion, recreational facilities and related needs were often in short supply. Eventually San Francisco District was even given the responsibility of recruiting personnel whose duty stations would be in overseas areas.

To provide needed troop-training and related facilities the Army immediately began to expand its existing bases principally by rehabilitating camps and contonments built during World War II. This was augmented by some new construction, and by expanding bases then in use. In the early stages of the conflict, the major portion of the engineering design work attendant to these projects completed by San Francisco and other Districts, was accomplished by government personnel. As the full impact of the conflict became more pronounced, and took its place in the pattern of international developments, new installations were activated and new construction was authorized in volume.

District Engineer 1949-1950
Col. Fremont S. Tandy

Priorities were established, and for the most part deadlines met relative to San Francisco District's work placement early in the war. Even so, the Engineers remained handicapped in their efforts by having to put projects out to bid. This situation was corrected, when on December 28, 1950, Office, Chief of Engineers (OCE) authorized District Offices to negotiate contracts where necessary to meet required completion dates. This was the result of President Truman's declaration of a National Emergency on December 16, 1950 which, in effect, authorized the Department of the Army to negotiate for purchases and contracts for supplies and services.

At the same time, the accelerated construction program necessitated the utilization of architect-engineer services for design, and enabled contracting agencies to operate without an inordinate increase in personnel strengths. The fact of the matter was that, by early 1951, it became apparent that the construction program would be accelerated beyond the manpower of the Districts. Charged as they

were with incredible military construction programs, they would be unable to cope with the situation unless modifications were made. This was especially true for San Francisco District, due to the extremely large geographic area to be served and the wide variety of projects to be completed.

The result was that San Francisco, and other Districts, utilized their designers and technical experts for establishing criteria with the using services, and for reviewing and checking the designs submitted by architect-engineers. By the fall of 1951, approximately 95 percent of San Francisco's engineering design workload was being performed under architect-engineer contracts. To illustrate the tremendous expansion of military construction in the District for the Army and the Air Force, there is set forth below a table indicating the dollar value of construction placed by the District in the Fiscal Year 1950 (before Korea) as compared with that placed during Fiscal Year 1951, and construction expected to be placed in Fiscal Year 1952:

Fiscal Year 1950	$4,799,070
Fiscal Year 1951	$38,819,291
Fiscal Year 1952 (estimated)	$145,000,000

Yet another indication of the amounts spent and the urgency of the construction program was the lifting of the five million dollar authorization limit imposed upon Division Engineers. Throughout the last half of 1950, the Division Engineer could only approve negotiated contracts not exceeding five million dollars. So that unnecessary paper work might be avoided, and so that critical work would be accomplished on time, the South Pacific Division Engineer was, on February 21, 1951, granted authority to approve contracts up to $15 million. This represented a three-fold increase over previous authority and was quite beneficial in getting projects moving.

The San Francisco District's Korean War construction effort can be divided into four major phases. The initial phase was the rehabilitation of Army camps and depots. Specifically, these included Camp Roberts, Fort Ord, Hunter Liggett Military Reservation, Fort Baker, Camp Stoneman, the Oakland Army Base, Dugway Proving Ground, Deseret Chemical Depot, Tooele Ordnance Depot, Utah General Depot and similar facilities. It will be remembered that, in our haste to return to "normalcy," we shut down many of our bases and sold off others. Now we had to very quickly knock off the dust of half a decade, cut away the dry rot, and put things in shape. Once again this meant repairing and constructing troop housing, mess halls, hospitals, classrooms, chapels, along with the usual electrical, water and sewer systems. Two significant projects in the Bay Area were the overhauling of the San Francisco Port of Embarkation and the Oakland Army Base. For here were not only all the normal construction projects completed, but extensive repair and replacement of trackage for the railroad, and the expansion of port, berthing, troop and cargo handling facilities were undertaken.

District Engineer 1952-1953
Col. Henry Walsh

To assist the District Engineer in the coordination of activities with the Commanding General, Sixth U.S. Army, headquartered at the Presidio, a North Project Office headed by Ralph Blyberg was established, as well as a South Project Office under the supervision of George Reilly. When Reilly became Assistant Chief of the Engineering Division, Reuben Johnson was selected to take his place.

The North Project area, sometimes referred to as "Presidio and Satellites," oversaw the rehabilitation and new construction at the Presidio of San Francisco; Forts Mason, Funston, Baker, Barry and Cronkhite; the Two Rock Ranch Radio Station and the two National Cemeteries in the area. In addition, the more than half dozen 90 and 120 millimeter anti-aircraft batteries that were constructed around the San Francisco Bay Area, fell within the purview of the North Project Office.

In the South Project Office, George Reilly, and later Reuben Johnson, coordinated the architect-engineer and contract construction work toward rehabilitation of World War II structures and field training facilities, as well as the design and construction of new building. Major camp projects in this area were Fort Ord, Camp Roberts, the Hunter Liggett Military Reservation and Camp Parks.

The second phase involved the accelerated program of Air Control and Warning (ACW) stations, construction of which began in the late fall and early winter of 1950. To the existing World War II-era aircraft warning and direction finder stations were added the new, more powerful "gap filler" ACW units. These were placed along the coast, and throughout the basin and range country of the inter-mountain west.

The third phase was rehabilitation of Air Force bases within the District. Initially this meant all of the major bases in northern and central California, Nevada and Utah. But when the northern counties were transferred to Sacramento District during January 1951, the San Francisco District concentrated its efforts on the large Strategic Air Command Bases located in the Central Valley region, upon Hamilton Air Force Base in Marin County and bases in Nevada and Utah. Improvements included runway resurfacing (to meet new standards required for jet aircraft) fuel storage, base housing communications networks, hangars and related facilities.

The fourth and final phase of construction begun during the Korean war was the initiation of Air Force base expansion, which continued throughout the 1950s and into the 1960s. This phase also inaugurated the long-needed modernization of Air Force bases. In addition to barracks, training buildings, and warehouses, a great variety of other facilities were put up by San Francisco District for the Air Force. Among these were new community centers, service clubs, dental clinics, schools, post exchanges, commissaries, officers' quarters, steam plants, medical clinics, dormitories, chapels, housing for dependents — in fact just about anything and everything needed in a typical community.

The expansion program, especially, caused the District's real estate function to grow during and after the Korean War period. In the

first year of the conflict, the value of real estate work performed increased from about $500,000 to more than a million dollars. By the end of June 1952, the value was approaching the ten million dollar mark! While the primary emphasis was on land acquisition — more than 300,000 acres — the real estate mission also handled disposal, space utilization and leasing activities.

The new, larger aircraft — such as the B-36, B-47 and eventually B-52, required much longer airstrips for their operations. Moreover, the ground support facilities needed to service these craft were quite different from those of the previous generation. Special jet-fuel storage and handling units, the storage and handling of atomic weapons, and similar facilities for air-to-air and air-to-ground rockets, these and more, required additional space and more sophisticated safety requirements.

Acting as agents for both the Army and the Air Force, San Francisco District real estate personnel obtained essential tracts for both strategic and tactical operations. In addition, they secured land for training centers, bombing ranges and gunnery ranges. Finally, much time was spent, especially in California and Utah, in search of adequate office space. To handle the initial crush of work during 1950, a real estate sub-office was established at Fort Douglas, Utah. That office was closed, however, once the first rush of work was completed.

Recognizing that large portions of government land were not needed for military purposes all the time, the District's Real Estate Division made frequent inspection tours with a view toward maximum utilization of property under their control. This resulted in substantial tracts being made available to the private sector. Lands suitable for livestock grazing were particularly in demand. In California, thousands of acres within Camp Roberts and the Hunter Liggett Reservation were leased for that purpose. Similarly, huge sections in Nevada and Utah were leased to cattle companies.

Related to real estate, but for a different purpose other than purely military construction,was the involvement of the District in the Wherry Act housing program. This law, passed in 1948, was the logical extension of the first military housing legislation, known as the National Housing Act of 1941. Under the provisions of the Wherry Act, private enterprise built and operated rental housing units on and adjacent to military installations. To implement this program, the Federal Housing Agency (FHA) loaned money to responsible private companies, up to the limitations as set forth in the law. The company would in turn finance the remainder of the required construction costs and would, as well, operate the completed project.

Responsibility for the administration of all Wherry Housing projects in the South Pacific Division was assigned to the San Francisco District on July 7, 1950 — not quite a month following the Communist invasion of South Korea. In administering this program, it was the District's responsibility to select and award contracts to private architect-engineer firms. Moreover, the District had to direct the entire bidding process, issue invitations, provide specifications, and then certify the low bidder to the FHA. By late 1951, San Francisco

District, working with the FHA, had authorized the construction of nearly 1800 housing units at a dozen installations across the South Pacific Division.

Yet another major function assumed by the San Francisco District during the Korean War period was that of military procurement and supply. Prior to its transfer to the District, the San Francisco Procurement Office was located on the Oakland Army Base and was operated directly by the Office, Chief of Engineers (OCE). On August 15, 1950, the Procurement Office function was transferred to the San Francisco District and placed under the supervision of Theodore Waale.

With this reassignment, San Francisco District became one of seventeen field agencies designated to provide contract services (labeled COR) for contracts executed by other Engineer offices. To fulfill the requirements of the COR activity, San Francisco District found it necessary to establish a pair of sub-offices, one in Sacramento and another in Denver.

A few months later the District's supply mission was again enlarged when it was assigned a significant portion of the spare parts program from the Columbus (Ohio) General Depot. The inital impact of this action created an immediate procurement backlog of some 14,000 spare parts items. With several management improvements, and by hiring additional personnel, the backlog was soon reduced to a normal operating volume. Like other programs of the District, the dollar value of military supply and procurement soared during the first year of the war.

The table below is illustrative of this growth.

Fiscal Year	Line Items Processed	Dollar Value
1950	19,970	$2,390,720
1951	46,816	$21,714,011
*1952	65,350	*$34,230,000

*Estimated

District Engineer 1953-1954
Col. A. J. Goodpaster

Closely allied to the procurement and supply mission were the functions of Industrial Mobilization Planning and the rendering of procurement services to the Okinawa Engineer District. Finally, those involved in supply also supervised and operated a packing plant at Richmond, California, for packing and processing overseas equipment and supplies.

Probably the largest single item sent overseas was the hopper dredge *Davison*, which had been operating, up to the summer of 1950, in and about the San Francisco Bay Area under the supervision of the San Francisco District. On September 14, 1950, by order of OCE, the *Davison* and her 47-man crew was requested to proceed to Sasebo, Japan, and report to the Far East Commander. Soon thereafter, the 700 cubic yard dredge was placed in drydock and readied for her overseas tour. She departed San Francisco Bay on September 25, 1950.

The fighting in Korea ended on July 27, 1953, with the signing of an armistice agreement by the United Nations and Communist representatives. The end of the war in Korea, however, did little to lower worldwide military tension, nor did it end our troubles with Asian Communism. Nonetheless, the San Francisco District could look back with pride to its truly phenomenal military construction and supply efforts, undertaken and accomplished during this period of crisis.

Even though the shooting had stopped, the Cold War and the international arms race of the middle and late 1950s continued unabated. Announcements, such as that made on August 8, 1953, by Soviet Premier Malenkov wherein he stated that the United Staes no longer had a monopoly on hydrogen bombs, did little to ease American minds relative to Soviet intentions. On the other hand, when Secretary of State John Foster Dulles asserted that our new defense policy was based on instant and massive retaliation, the Communist bloc nations were not won over by our easygoing attitude. The end result was that the Corps of Engineers was thrust into the largest peacetime military construction program in its history.

Offensively this took the form of almost total modernization of our Air Force and Army installations. Begun during the Korean mobilization effort, and carried forward during the late 1950s, construction was prosecuted amid the world's full range of climates and terrains in more than twenty foreign countries and on some 700 domestic bases and installations.

Typical Air Force work done by the San Francisco District during these years is exemplified by projects completed at Hamilton and Castle Air Force Bases.

Hamilton AFB, one of the oldest in the nation, was created by a bill introduced into Congress on July 3, 1930, and later signed into law by President Hoover. It was named to honor Lieutenant Lloyd A. Hamilton, who was killed while on a combat mission over Belgium during World War I. Construction of the field was begun by the Quartermaster Corps prior to 1933 and continued by the San Francisco District, Corps of Engineers, beginning in 1941. For the most part, construction progressed almost continuously in a patchwork fashion for years. During the years of World War II, for instance, the main NW-SE runway was widened and lengthened at least four times. And during the last years of the war, aprons and taxiways were added and improved.

In the years just prior to and during the Korean War, extensive work was done on the runways — again widening and lengthening them to accommodate larger, heavier aircraft. Then during the years following the Korean conflict, the runways were not only completely rehabilitated, but were augmented by the construction of warm-up aprons, maintenance and operation aprons and primary taxiways.

Two reasons can be discerned for the continuous need to re-surface, maintain and enlarge Hamilton AFB. One had to do with the geology of the field. The base was built upon reclaimed mud flats on the western shore of San Pablo Bay, the northern arm of San Francisco

District Engineer 1954
Col. W. F. Cassidy

Bay. Here the mud varies in depth from 30 to 60 feet and is underlain. Over the years, settlement of the pavements, due to consolidation of the underlying bay mud, caused the runway, aprons and taxiways to crack, thus necessitating the need for overlayment and rehabilitation.

The second reason was the amount and kind of traffic using the field. Hamilton AFB had been, for years, used almost exclusively by fighter, light bomber and light cargo aircraft. The graph below, however, shows the introduction of heavier planes, which accounted for at least some of the damage to the facility and thus were responsible to a degree for the need to strengthen the pavements.

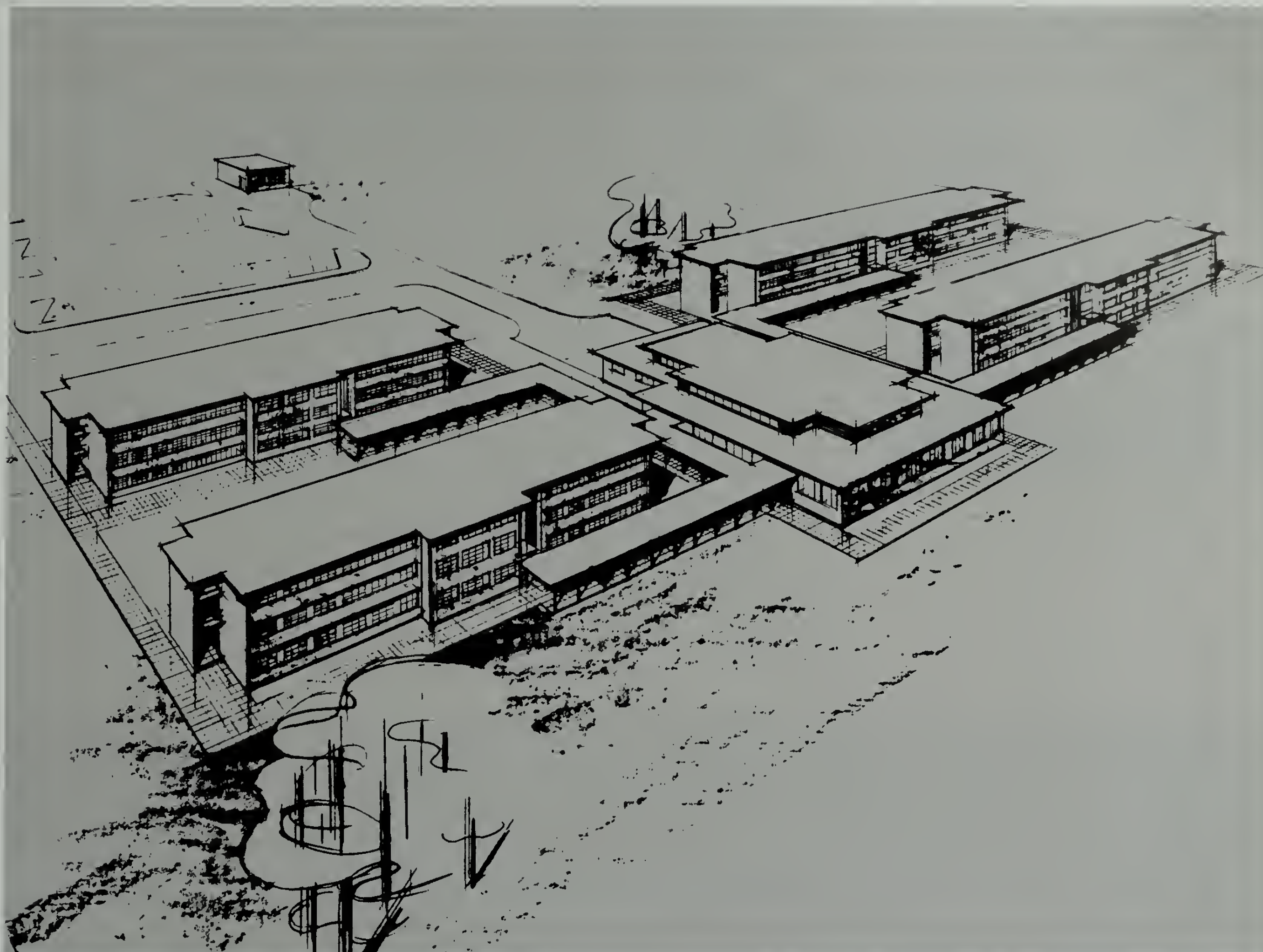
Hamilton Air Force Base
Runway Traffic 1956

Type of Plane	Average Traffic Cycles Per Month
B-25	180
B-26	45
B-29	45
B-36	45
C-45	180
C-47	180
C-54	45
C-119	45
C-121	45
C-124	45
C-131	45
F-80	270
F-84	270
F-86	270
F-89	270
Miscellaneous	90

Note: Traffic cycle denotes one landing and one takeoff with an aircraft.

By 1956, Hamilton was the home of a jet interceptor group, accompanied by light bombers and light cargo planes. Physically, the pavement area consisted of the main 400′ by 8,000′ NW-SE runway, various service aprons, taxiways, two dozen hardstands, a system of perimeter taxiways and Air Defense Command (ADC) facility.

Castle AFB, one of four SAC bases in the state of California, traces its beginnings to December 7, 1941, when a flight of 34 BT-13 aircraft landed on the never-before-used runway at Merced Army Flying School. This began a long history of use as both an operational and flying training base. Merced Army Airfield was later redesignated Castle AFB to honor Frederick W. Castle, a B-17 pilot and Medal of



Messhall and dormitories at Castle Air Force Base, Merced, California.

Honor recipient killed over Germany in December 1944. Eventually the base grew to the point where it became responsible for training nearly all SAC B-52 and KC-135 combat crews. In addition it became the home of a squadron of F-106 fighter interceptors.

Original construction of this base was done by the Sacramento District and then turned over to San Francisco District after World War II. During the period of modernization following the Korean War, the main runway was strengthened so as to accommodate the 250,000 pound gear loads brought to bear by the B-52 bombers and the KC-135 tankers using the field. And as was the case at Hamilton, the main flight strip was augmented by taxiways, aprons, stub parking areas, warm-up pads, nose docks and parking areas. Additionally, the ADC facility consisted of an alert apron, an alert hangar, an operational apron and three taxiways.

In the case of Castle, the damage to the pavements was due primarily to overstressing by aircraft considerably heavier than that for which they were designed. Hence, considerable rehabilitation work was done there by the San Francisco District to ensure that the primary facilities were ready at all times for operation use. For it must be remembered that these were the days prior to the deployment of

District Engineer 1954-1957
Col. John A. Graf

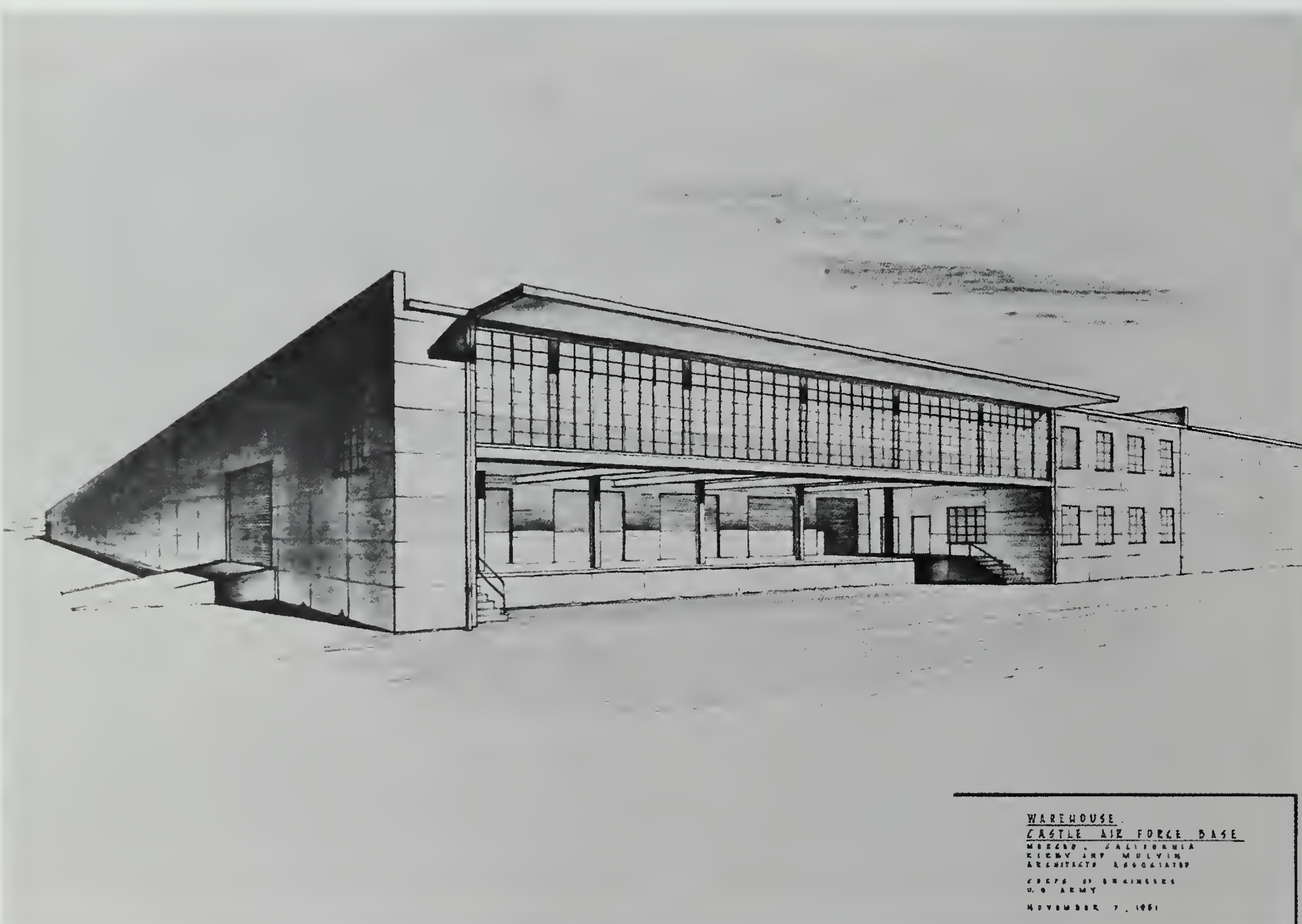
intercontinental ballistic missiles and our Nation relied upon its long-range bombers to deliver "instant and massive retaliation."

Besides the lengthening, widening and strengthening of the landing and associated pavement areas on the District's Air Force bases, the Engineers also designed and constructed great varieties of permanent facilities. These included ground support systems for the aircraft such as sophisticated fuel distribution systems, and storage facilities, as well as specialized crew-readiness areas, officers' quarters and a host of other projects.

The San Francisco District was equally busy on the large Army installations. In the main this was in support of Sixth U.S. Army programs, headquartered at the Presidio of San Francisco since 1946.

The Presidio became the administrative base while Fort Ord, with its thousands of permanent military and civilian personnel, evolved into the region's largest basic and advanced training facility for infantry units. Fort Ord had two sub-posts, the smaller of which is the Presidio of Monterey, home of the Defense Language Institute.

The second sub-post is the Hunter Liggett Military Reservation. Besides providing almost unlimited space for training exercises, the reservation developed into a field laboratory for the Combat Developments Experimentation Command, headquartered at Fort Ord.



On these and other posts across the District, temporary and emergency type construction was replaced by well-thought out and well-designed permanent structures. Hospitals, clinics, chapels, dormitories and essential support systems — as modern as put up anywhere — were built by San Francisco District during the modernization program.

Fort Ord was also the site of the first Capehart housing project on the Pacific Coast. This Congressional program replaced the Wherry Housing Program, and was designed to provide homes for military personnel through private enterprise. San Francisco District's responsibility for this new building effort was similar to that it exercised under the earlier law.

Under the Capehart Act, a revolving fund was established, known as the Armed Services Housing Mortgage Insurance Fund, which was available to insure mortgages on family houses constructed for military families. It further empowered the Secretary of Defense to enter into contracts with private corporations for the construction of quarters. The average mortgage could not exceed $16,500 per house including utilities, roads, etc., plus $1,000 average per house for "off-site" utilities, roads, etc., required for access and service to the project. A major difference in this Act as compared to the Wherry Act

was that, under Capehart, the Army assumed ownership of the homes upon their completion.

As of December 6, 1956, housing projects under the supervision of the San Francisco District, were located on the following installations:

Fort Ord
Two Rock Ranch
Benicia Arsenal
Oakland Army Terminal
Dugway Proving Grounds
San Francisco Defense Sites
Indian Springs, Nevada
Wendover AFB, Utah

A few months earlier, in October 1955, the military boundaries of the San Francisco District were altered once again. Military construction work in the state of Nevada (except Lincoln and Clark counties) was transferred to the Sacramento District. In turn, the responsibility for Travis AFB, near Fairfield, and for Sharpe General Depot, near Stockton, was transferred from Sacramento District to San Francisco District.

This modification took place just as the District was gearing up for the possibility of nuclear attack from the Soviet Union. For, as additional information relative to Russian air strength became available, defense officials came to see that such an eventuality could in fact, take place should the communists deem it in their best interests.

To protect the nation from destruction, antiaircraft missile systems were developed to replace conventional weapons. And as our

Nike Ajax protect the Bay Area – 1958.

missile preparedness program accelerated, construction of the more conventional defense systems diminished proportionately. For example, in fiscal year 1957, 37 percent of the Army's total military construction program was in support of various missile projects. By the end of the next year, the percentage had climbed to 48. The advance in missile construction for the Air Force was even more dramatic. Allocations there jumped from 2 percent of the total 1957 budget to approximately 50 percent by 1960.

The first antiaircraft missile system developed on a large scale was called Nike and it became operational as the war in Korea was winding down in 1953. The Nike Ajax, as the first of this family of missiles was labeled, was capable of destroying a single enemy bomber some thirty miles from its target. In the main, the system was designed to supplement our fighter interceptor squadrons standing ready along the coast.

San Francisco District played a major role in the installation of this missile program. The District secured the required lands and designed and built the support facilities needed to fuel, fire and control the new weapon. Included in this package were special types of electrical generators, air compressors, air conditioners, underground storage facilities, generator buildings, mess and housing units for weapons crews and support personnel, and radar sites.

In reality, this program was the logical extension of San Francisco District's traditional fortification role. Following World War II, the big 16-inch guns at Batteries Townsley and Davis were dismantled (1948). Two years of comparative quiet followed for the District's seacoast batteries, until the Korean War brought a new mission: antiaircraft defense and a new type of armament, 90 mm and 120 mm antiaircraft guns.

Nike Ajax on Angel Island – 1955.

Fort Baker, the first fort to be carved out of the original 1850 Lime Point Military Reservation, became home for Headquarters, Western Army Antiaircraft Command in July 1951. The command had first been established at Hamilton Air Force Base on September 1, 1950. In 1955 the name of the command was changed to 6th Regional Anticraft Command and early in 1957 the designation was changed once again to 6th Region, United States Army Air Defense Command.

Fort Scott, once the headquarters of the Harbor Defense of San Francisco Bay became home of Headquarters, 30th Artillery Group. In the early 1950s, the 30th Group consisted of the 9th Gun Battalion (120 mm) and the 718th and 728th Gun Battalions (90 mm) whose batteries — constructed by the San Francisco District — were located at such places as Point Moreno, Richmond, Emeryville, Alameda, San Francisco's Golden Gate Park and the Olympic Club, as well as various locations within the boundaries of the old seacoast installations, Forts Scott, Cronkhite and Funston.

Although greatly improved, especially when controlled by radar installations built by San Francisco District, these 90 mm and 120 mm guns of the early 1950s were of World War II vintage, and their phasing out began in 1954, with the placement of the Nike Ajax missiles around the Bay.

When the first of these arrived from Fort Bliss, Texas, the old seacoast artillery forts got a good share of the many temporary above-ground Ajax missile sites that were emplaced in a rough circle around the strategic San Francisco Bay Area.

Nike site, Rocky Ridge. Fort Barry – 1957.

Eventually these temporary missile sites gave way to permanent ones at Forts Barry and Cronkhite, sites 87 and 88; at Fort Scott, site 89; at Angel Island, site 91; and at Fort Funston, site 59. In addition to these located in the old forts, there were several other sites built by San Francisco District, especially in the East Bay area.

Even before the Nike Ajax became operational, the next member of the Nike family, Hercules, was already on the drawing boards. Armed with a nuclear warhead, the Hercules version was longer, heavier, faster, more maneuverable, much more powerful, could fly farther, and could destroy an entire formation of enemy aircraft. These became operational in 1958.

For San Francisco District, the final change in the type of armament emplaced in the former coast artillery forts occurred in 1959, when the nuclear capable Nike Hercules air defense missile became available for troop use. The first Nike Hercules battery to become operational in 6th Region was site 88 at Fort Barry. Eight months later, Fort Cronkhite's site 87 received the new weapon. Before long, the entire Bay Area was ringed with Hercules installations built by the San Francisco District.

During this same period, another surface-to-air missile (SAM) made a brief appearance on the scene. Christened Bomarc, it was planned that this winged, solid fuel missile would destroy enemy aircraft and airborne missiles as far away from their targets as possible — possibly 400 miles. Among the advantages of the Bomarc were: (1) relatively little space was required for installation; (2) firing was pretty much automated, thus a minimum of firing crews was required; and (3) only infrequent inspection and maintenance were required to keep the missiles ready for launching. In 1959 the installation of Bomarc guided missile facilities was begun by the San Francisco District on Travis Air Force Base and at a site near Dixon, California. During the spring of 1960, work on these projects was halted. According to an Air Force announcement dated March 25, 1960, a $300 million cutback in the Bomarc missile program was ordered to provide more funds for the Atlas Midas early warning satellite and Century programs. It is thought that an additional reason for suspension of the Bomarc program was that significant funding and research was going toward the development of a still more sophisticated member of the Nike family, the anti-missile missile, Zeus. Hence, funding the Bomarc would dilute the Nike Zeus work.

The Nike program was the last military construction program handled by the San Francisco District. Under OCE General Order No. 9, dated April 7, 1961, the Sacramento District assumed responsibility for military design and construction for San Francisco District projects. Moreover, San Francisco's real estate functions were also transferred to Sacramento.*

At about the same time, however, San Francisco District initiated a rather large Civil Defense program. As part of this program,

District Engineer 1957-1960
Col. John S. Harnett

*See Appendix C for a list of Army installations within the nine counties of the Bay Area during the period 1850-1958.

District Engineer 1960-1963
Col. John A. Morrison

some vital communications and command centers were placed underground, while others were targeted for emergency relocation. Throughout the District, existing structures in all major population centers were identified, examined and classified relative to their capacity to provide shelter in the event of a nuclear attack.

Another phase of the Civil Defense program was informational and educational in nature. Individuals and corporations were encouraged to actively participate in the program. Information was distributed to the public showing how structures might be improved to provide safe shelter. District personnel became proficient in shelter design, the detection and prevention of nuclear radiation hazards, and the organization of teams designed to aid population centers should the need occur. They, in turn, communicated their knowledge to the community through public meetings and related activities.

On January 1, 1968, Civil Defense support for the state of Utah was transferred from San Francisco District to Sacramento District. Simultaneously, the work in ten Northern California counties was transferred from Sacramento to San Francisco.

The last contact with purely military functions handled by the San Francisco District had to do with procurement and supply and inspection activities. Procurement and supply functions continued to support our overseas bases and to provide critical materials to the missile program, until July 1963, when a San Francisco Procurement Office was established under the Army Materiel Command. Military procurement activities for both the San Francisco District and the Seattle District were then consolidated under a new Department of the Army office, located at 1515 Clay Street in Oakland.

San Francisco District issued its last military supply purchase orders and contractual documents on June 30, 1963. Over the next two months, the personnel assigned to that function continued working at the District Office, until the end of August when the work on the outstanding contracts was completed. During this time, some 95 employees involved with purchasing, contract administration, inspection and industrial readiness activities were transferred to new offices. Other employees attached to military functions, but not wishing to relocate, transferred to different government agencies or found work in private industry.

Due to the reorganization, the Supply Division of the San Francisco District was reduced to a small group primarily concerned with purchasing the necessities for the District Office and preparing for on-going Civil Works construction and services.

In 1965 the inspection function was transferred from Supply Division to the Construction-Operations Division. This included the inspectors who were responsible for quality control on procurements made from manufacturers within the District's boundaries. This service continued until 1967, when the Defense Contract Administration Office was established and assumed full authority for all contracts assigned to manufacturers in the San Francisco area. With this transfer of responsibility, the San Francisco District's association with military projects ended.

San Francisco District contributions to the field of military construction in support of the security of the Pacific Coast and to the Army and Air Force commitments world-wide were truly significant. For more than a century the District provided the technical know-how to accomplish every sort of military construction project. All the way from the era of the muzzle loaders through the time of guided missiles, San Francisco District men and women measured up to the tasks and challenges assigned. Being relieved of their military mission, they would now turn their full attention to flood control, navigation and environmental protection. Here too they would continue the tradition of excellence for which they were known.

Nike Hercules, Fort Barry – 1959.

Chapter VII

Flood Control

Policy

It is generally recognized that the existing federal flood control program was set in motion about 1879, when flood protection became an integral part of the federal navigation program on the lower Mississippi River. Toward the end of the nineteenth century it had, for the most part, been divorced from navigation. As a separate program, flood control evolved slowly, until it embraced all of the Mississippi River.

During the quarter century that elapsed between 1890 and 1916 floods were rampant not only in the Mississippi basin, but throughout most of the United States. Over the years it became increasingly evident, as President Roosevelt's Inland Waterways Commission reported in 1908, that plans for the improvement of navigation should also consider the control of floods. At about the same time, a special committee on floods and flood prevention of the American Society of Civil Engineers pointed out that flood control must not be subordinated to navigation. Moreover, it soon became obvious that levees constructed along the Mississippi and Sacramento rivers by local interests simply could not withstand the stress and strain of major floods. Consequently, on March 1, 1917, Congress, recognizing that federal participation should be broadened in scope, authorized millions of dollars for levee work on the Mississippi River. At the same time, they approved federal participation in the construction of levees, channel improvements, and weirs in the Sacramento Valley, in conformity with flood protection plans of the California Debris Commission. This Commission, composed of Corps of Engineers' officers from San Francisco, was established by act of Congress in 1893, and was concerned with navigation and flood control problems that arose because of hydraulic mining. The 1917 act also directed the Corps of Engineers to examine the possibilities of water power development, as well as navigation and related development, in the course of its surveys for flood control.

Congress, on March 3, 1925, directed the Secretary of War, acting through the Corps of Engineers and the Federal Power Commission, to prepare and submit cost estimates of investigations of all navigable streams (except the Colorado River) and their tributaries with a view to formulating plans for the most effective improvement of these streams for navigation, power, flood control and irrigation. When completed, these estimates were published in House Document 308, Sixty-ninth Congress, First Session.

The River and Harbor Act of January 21, 1927, authorized the Corps of Engineers to undertake the investigations listed in House Document 308. The subsequent reports made have become widely

Opposite page: Three flood victims row to safety over the water of Corte Madera Creek.

known as simply the "308 Reports," and several of the tentative plans for large multipurpose federal projects were outlined in them.

Due largely to the disastrous floods on the Mississippi River that same year, Congress, on May 15, 1928, adopted a project which embraced both levees and diversion floodways, and directed the completion of studies for supplementing the levees by a reservoir system. Of particular significance, the 1928 act modified the previous policy in that local participation in projects was materially reduced. Finally, the 1928 law recognized flood control as an individual problem that should be separated from that of navigation.

It was not until the Flood Control Act of 1936, however, engendered by the culmination of hydrologic, economic, and political events, that a completely national, federal, flood control policy was enacted. Economically the United States was in the midst of a great depression. Politically it was a time of changes in executive leadership coupled with drastic modifications in governmental theory. Hydrologically, the nation suffered severe droughts during 1930, 1931, 1933, 1934 and 1936, while floods ravaged the country from New York to California in 1934, 1935 and 1936. These natural disasters, falling as they did at a time when national policies were being formulated and adjusted in an attempt to overcome economic depression, crystallized efforts that led to the adoption of a nationwide flood control policy. In sum, this new law recognized that floods resulting in the loss of life, disruption of commerce and erosion of the land constituted a menace to national welfare. Further, it was the sense of Congress that flood control was a proper activity of the federal government, in cooperation with state and local political subdivisions. Finally, the act recognized that the improvement of watersheds for flood control was a proper federal function.

An important amendment was made to the 1936 act just two years later which relieved local interests of the burden of furnishing lands for reservoirs. Henceforth, the full cost of building reservoirs and maintaining them would be the obligation of the federal government. Then in 1944, a landmark act further defined federal policy with specific reference made to state rights and the duties of the Secretary of War with respect to flood control operations at all reservoirs constructed wholly or in part with federal funds.

Another signal piece of legislation was the Water Supply Act of 1958, wherein it was declared that it would be the policy of the federal government to aid states and localities by providing storage for present and future municipal and industrial water supplies in federal reservoirs. Most significantly, the 1958 Act provided that the value of such water supplies be included in the economic justification of such reservoir projects.

In recognition of the increasing use and development of flood plain areas (this is especially true within the San Francisco District) and the need for flood hazard information to guide such development, Section 206 of the 1960 Flood Control Act, as amended by the 1966 and 1970 Flood Control Acts, the Water Resources Development Act of 1974 and Executive Order 11296 of August 10, 1966, authorized the Corps of

Engineers to establish and carry out a flood plain management services program. The primary objective is comprehensive flood damage prevention planning that, at all levels of government, encourages and guides prudent utilization of flood plains.

Under this program, the Corps of Engineers prepares flood plain information reports, provides technical assistance and guidance, conducts related research on various phases of flood plain management and plans long-range flood plain management activities. In compliance with Executive Order 11296, the Engineers prepare specific flood hazard reports wherever buildings, roads and other facilities are either federally owned, federally financed, or involved in federally administered programs, and wherever disposal of federal land and property is involved.

Finally, to achieve the basic goals of the flood plain program, the Corps of Engineers, with and through the proper state agencies, provides guidance engineering services and other technical assistance necessary for sound managment of flood plain areas. State and local officials are brought fully into planning actions and consideration is given to alternative or supplementary measures. Thus, planning considers flood control works, flood proofing of buildings, flood forecasting, zoning subdivision regulations, building codes, city policies, environmental values, and other elements to find the combination that affords the best solution.

Briefly then, the above are the fundamental policies under which the San Francisco District builds flood control works and provides other services designed to prevent loss of life and property damage due to floods. In addition to these, the District has made extensive use of its authority to implement emergency measures to save lives and property during times of flooding. Emergency flood control work falls into three general categories:

1. Emergency Bank Protection (Section 14, 1946 Flood Control Act, as amended). Within the limit of available funds, the Corps of Engineers is authorized to spend up to $250,000 annually in a single locality for the construction of emergency bank protection works to prevent flood damages along shorelines or to highways, bridge approaches and other public works endangered by bank erosion.

2. Snagging and clearing (Section 208, 1954 Flood Control Act, as amended). Within the limit of available funds, the Corps of Engineers is authorized to spend up to $250,000 annually on any one single tributary for removal of accumulated snags and other debris, and for the clearing and straightening of channels in navigable streams, when such work is needed in the interest of flood control.

3. Flood fighting, rescue and repair work (Public Law 84-99 and antecedent legislation). Under this law, the Engineers are authorized to engage in flood fighting and rescue operations and to repair or restore flood control works threatened or destroyed by floods.

For the San Francisco District, this latter section has been especially important in protecting people and property in the North Coast area, where no substantial flood control dams or reservoirs have been built.

Floods

From 1770 to 1972, 34 major rain and/or snowmelt floods occurred within the State of California. These floods claimed more than 350 lives and resulted in well over a billion dollars in flood damages. Some of these floods inundated vast areas. For example, in 1805, floods in the Great Central Valley covered the entire valley floor. In 1861-62, the near-legendary flood, often referred to as the "Noachian Flood of California" transformed the Central Valley into an inland sea, covered much of the Los Angeles River Basin, inundated extensive areas along the coast and ravaged the coastal valleys. This unprecedented flood put rivers everywhere over their banks, spreading ruin and devastation for miles around; dry creeks and arroyos became raging torrents and all the lowlands were converted into shoreless lakes. Until the flood waters subsided, business and transportation were at a standstill, thousands of cattle and other livestock perished and possibly a fourth of the state's taxable wealth was destroyed. So great was this flood that, when coupled with the two succeeding years of drought, it brought an end to the "pastoral era" in California's history. In addition to these, residents of the San Francisco District repeatedly suffered severe flood losses in 1867, 1907, 1909, 1938, 1940, 1955, 1964, 1966-67 and 1969.

In large portions of the windward slopes of San Francisco District's northern Coast Ranges and northern mountain region, annual precipitation is 50 inches and more. For selected areas of this northern region, however, mean annual precipitation is 120 inches — ten feet of water! Although flooding can occur at anytime of the year, the worst floods usually occur in winter as a result of prolonged, widespread rainstorms accompanied by above-normal temperatures that melt the snowpack. And because the topography of the San Francisco District is so varied and subject to rather unique weather patterns, small drainages are often subject to flooding from localized storms. A review of three floods, those of 1955-56, 1964-65 and 1969 will illustrate the disastrous consequences of flooding in the District, as well as some of the emergency measures implemented by the Engineers to alleviate the damages.

The flood of December 1955, was the greatest disaster of its kind, to that date, which ever occurred in California — greater even than the historic deluge of 1861-62. Seventy-four lives were lost and property damage ran between $150 million and $200 million. Rains covered 60 percent of the state, putting nearly a million acres of agricultural land under water. Rail, highway and air travel were

disrupted by floods, landslides, splintered bridges and extremely foul weather.

The first news to reach the public about the impending disaster was concerned not with the rain, but with the violent winds that ushered it in. During the early evening of December 18, television stations in San Francisco went off the air for several hours. Blasts down Market Street drove pedestrians to shelter and crashed in plate glass windows. In other areas, roofs were ripped off and trees and power poles were bowled over by winds up to 110 miles per hour. Off the Golden Gate, four freighters rode out the storm, unable to get harbor pilots aboard. High atop Nob Hill, the roof of the magnificent Grace Cathedral began to rip apart. This was only the beginning of the major assault by the storm on the coast.

In the District's North Coastal Area the terrain on the watersheds of the streams is mountainous and extremely rugged. There are alluvial plains of varying extent along the coast near the outlets of the rivers to the ocean. At scattered locations along the courses of the streams there are small alluvial flats which occur as indentations along the sides of the V-shaped canyons. The works of man have encroached upon these alluvial plains and flats and along the canyon walls where highways and railroads have been located.

Along the Smith, Klamath, Mad, and Eel Rivers and Redwood Creek and their tributaries, the intense rainfall and resultant flood caused widespread destruction to the man-made encroachments within the rivers' domain. Even for those who were there at the time, the extent of the total destruction by the record-breaking flood flows was difficult to comprehend. A number of small communities were completely demolished by the force of the debris-laden flood waters. In the small town of Klamath near the mouth of the river and at Klamath Glen, a few miles upstream, there were few remaining whole buildings. Similar conditions existed along the south forks of the Eel River at the towns and settlements of Pepperwood, Weott, Myers Flatt Phillipsville and others. At several of those locations many of the buildings, together with logs, debris and automobiles, were piled in a jumbled mass against the base of the canyon wall.

Those areas near the mouths of the streams, particularly on the Eel and Mad Rivers, and Redwood Creek, devoted to agriculture and milling were completely inundated by flood waters, with resultant heavy loss of livestock and damage to farmsteads. A number of lumber mills were totally destroyed, with one large mill reporting the loss of a million boardfeet of dressed redwood lumber.

A major portion of the damage to state and county highways and roads, estimated at about $50 million, occurred on the coastal streams in Del Norte, Humbolt, Mendocino, Siskiyou and Trinity Counties. Several miles of highway along both sides of the canyons were destroyed by washouts or slides and a considerable number of major bridges were lost. Typical of these were the Klamath River bridge at Martins Ferry, the Trinity River bridge at Douglas City and Hoopa, and the bridge over Willow Creek, a tributary of the Trinity River. Railroad trestles were damaged and all commercial

communication systems were disrupted, isolating much of the area for several weeks. In many instances the only way to keep people from starving, and to treat illnesses, was by airlifting supplies and personnel into the cut-off settlements.

The first helicopter operations of the 1955 flood were in the Russian River resort area of Sonoma County, carried out by the 41st Air Rescue Squadron from Hamilton Air Force Base, despite the fact that the airfield itself was partly flooded out of service. Soon thereafter C-46's and C-54's were bringing food and supplies to the North Coast area.

It was through the inundation of the Russian River towns, in fact, that the public at large first learned of the serious flood conditions that were developing in California in December 1955. Guerneville had a substantial business section, and photographs flown out of the area and published Tuesday, December 20, showed stores half submerged and householders being rescued by boats. Before it was over, helicopters would be picking people off rooftops to save them.

There had been previous floods on the Russian River, the highest water of record being in February 1940. Thus residents were somewhat inured to flood danger and many of the houses in the area showed old high water marks. The general attitude of taking flood conditions calmly, however, did not reckon with the extraordinary condition of 1955, and from that time on, attitudes were altered significantly.

A mass of wrecked Stafford homes lie in the wake of the Eel River's December 1964 rampage.

To the south, in the San Francisco Bay Area, the situation was quite similar. In Napa County there had been previous experiences of damaging floods, especially in 1940 and 1949. During the 1955 flood, the Napa River set a record peak flow of 12,600 cubic feet per second at the gauging station at St. Helena, putting 300 acres of the city of Napa under water and causing 80 families to be evacuated from their homes.

Contra Costa County didn't figure prominently in published reports of flood conditions, but when figures on damage were compiled, it was found that private dwellings in the county had suffered the staggering loss of $1,250,000 that 460 families had been evacuated and that it had taken a working force of 1,500 Civil Defense personnel and volunteers, 300 federal troops and 75 National Guardsmen to meet the disaster situation.

The Contra Costa County area was an excellent example of a condition noted in various other areas — the flooding of the post-war subdivisions occupying low-lying tracts of land. The problem presented by developers building on known flood plains subject to periodic overflow was one that had seriously engaged the attentions of responsible state and federal officials. Barely two months before the December floods, a joint memorandum was issued by the San Francisco District and other agencies pointing out the inherent dangers in such developments. The memorandum stated that the District and other state and federal organizations were concerned with preventing or at least regulating the construction of houses and other

improvements on known flood plains.

In Alameda County, the principal flooding occurred in the low southwestern section and was due largely to the overflowing of Alameda and San Lorenzo Creeks. In addition, large areas of agricultural land in the Livermore and Amador Valleys were inundated by overflow from the tributaries of Alameda Creek. The flow of Alameda Creek was the greatest on record despite the fact that the entire discharge from a drainage area of 100 square miles was retained in a reservoir which did not exist at the time the previous record was established in 1911.

The places in Alameda County where organized evacuation had to be carried out were Niles, Alvarado, and in the Cherryland district near the city of Hayward. About 135 families were moved out, some of them in boats. Besides these areas, other residential areas (developed in the early 1950's) near Decoto and San Lorenzo were flooded by overflow from Dry Creek and San Lorenzo Creek respectively. It was estimated at the time that flood damage in Alameda County exceeded three and one-half million dollars.

Santa Clara County, lying at the south end of San Francisco Bay, experienced serious flooding for which there was no precedent in the county's history. All of the streams in the northern part of the county overflowed their banks, causing hundreds to flee ahead of the rapidly rising water. Typical of the flooding that occurred in this part of the Bay Area was that in Palo Alto along San Francisquito Creek. In addition, substantial numbers of householders in San Jose, Santa Clara and Alviso had to evacuate as well. Homes were protected and people rescued in the area when San Francisco District sandbagged certain critical places, and provided amphibious vehicles.

In Marin County, the rain was heavy and sustained. The town of Woodacre received 8.8 inches in 24 hours. One of the main commercial arteries of Marin County, Sir Francis Drake Boulevard, was under water in the Kentfield-Ross area. Power failure was extensive and some 2,000 telephones were inoperative. Tamalpais Valley, a community of new homes in 1955, built barely above the level of Richardson Bay, found water filling the streets and yards. There was heavy flooding of Raphael Village at Ignacio, a residential community occupied by Hamilton Air Force Base personnel. Many service families were evacuated. The base itself was gradually being flooded, and later all planes were flown to Travis, McClellan and other fields inside and outside the District. At Novato, a few miles to the north, there was also heavy flooding. To make matters worse, winds reached 100 miles per hour on Mount Tamalpais, Marin County's towering landmark, and blew the rain before it at 80 miles per hour in many of the lower, heavily populated communities.

Down the coast a ways in San Mateo County, the greatest concern was over the situation at Pescadero, a hamlet of a few hundred people set back a few miles from the ocean. The area was known to be flooded by the waters of Pescadero Creek Phone lines were down, the local water supply was unusable, and the only contact was through an amateur radio operator. This communication link was

broken when his antenna was blown down. During the storm a high-wheeled tank truck with 2,000 gallons of drinking water got through to the town, as did a sheriff's car to bring out an expectant mother, whose child was born on the way to the hospital.

Actual danger to life in Pescadero turned out to be slight, but some two dozen families had to leave their homes to flood waters. Damage to crops, however ran quite high, amounting to almost half a million dollars.

On the eastern side of the county more families had to be evacuated. The San Mateo County airport at San Carlos was damaged, not by water, but by strong winds. Two dozen hangars were flattened and about 35 private planes damaged.

The greatest damage in the San Francisco District's Central Coastal Area was caused by the record-high discharge of the San Lorenzo River. Within the city of Santa Cruz the river had a normal depth of four feet and flowed lazily along a channel averaging 100 feet wide. During the flood, water raced through it 22 feet deep, doubled the width of the channel, and overflowed to engulf virtually the entire business district and many square blocks of homes. Its flow was estimated at 30,000 cubic feet per second. There were five deaths reported in Santa Cruz and officials estimated damage to the business district alone to be some four million dollars.

At the town of Soquel, a few miles southeast of Santa Cruz, there was considerable damage in the business district when debris lodged against a bridge over Soquel Creek, which caused the diversion of the stream through town. A number of business establishments were completely destroyed.

In the southern part of Santa Cruz County, the Pajaro River reached flood stage and ran through the lower sections of the town of Watsonville. Earlier, in 1949, San Francisco District completed the Pajaro River Basin Project, at a cost of $748,000. The work consisted of river levees on both sides of the river extending a maximum of 12 miles and levees on each side of Corralitos Creek extending approximately two miles. But even these were over-topped and breached at a number of locations, causing flooding of a considerable acreage of agricultural land in the area.

Farther south, the Salinas River flooded to a lesser degree, and for some time caused alarm at Paso Robles and other points along its course. Rising in San Luis Obispo County, the Salinas flows northeast over an airline distance of about 175 miles and empties into the ocean near the center of Monterey Bay's coastline. Possibly because the rains began to taper off in intensity toward the southern part of the District, the Salinas did not develop so destructive a flood as was the case elsewhere. Another reason for the lower property damage in the area was that, three years earlier, San Francisco District cleared brush and trees from the river's bed, over a reach some 16 miles long and 300 feet wide, to allow the flood waters to escape to the ocean without causing a great deal of damage.

It is interesting to note that just prior to the December 1953 flood in California, several of San Francisco District's personnel were

on loan to the New England Division. For, on August 19, Hurricane Diane, following closely in the wake of Hurricane Connie, struck the states of Massachusetts, Connecticut, Rhode Island, and to a lesser degree New York, New Jersey and Pennsylvania. Answering the call for assistance, Eunice Burrows of Supply Division, Michael Berg and Bert Voss from Engineering, and auditor John Hogan immediately boarded a plane for Boston. They were assigned to field offices where they worked with some 600 other Corps personnel from throughout the United States. All were under the general supervision of the Federal Civil Defense Administration (FCDA), forerunner of today's Office of Emergency Preparedness.* They returned to San Francisco just in time to be involved with the December floods.

District Engineer Colonel John A. Graf, directing the District's flood restoration efforts, sent First Lieutenants Henry Flertzheim, Paul Hudson and Louis Manfre to resident offices where they could lend assistance to the overall work. Lieutenant Flertzheim was named Assistant District Engineer and sent to Eureka, where he was responsible for screening requests for repair to flood control works, and handling requests for stream clearance. Almost 20 years later, in 1974, he would return to the District as Colonel Flertzheim, District Engineer.

The Corps of Engineers spent $2,520,000 to repair damages caused by the December 1955 floods. They would spend almost ten times that amount to fight, and repair the damage caused by the floods of December 1964—January 1965.

The flood of 1955 served as a great learning experience. Following the disaster, almost immediate steps were taken to lessen the danger to life and limb should a similar situation happen again. Improvements were made in the areas of communication, civil defense organization, emergency supplies and to a limited flood control works. During the nine-year period from the flood of 1955 to that of 1964, San Francisco District completed a levee project on the Eel River in the delta area at Sandy Prairie. Finished in 1959, the work was designed to protect the town of Fortuna and adjacent areas from runoff of the magnitude experienced in 1955. The Corps of Engineers also completed a channel improvement and levee project on East Weaver Creek to protect the town of Weaverville. The largest and of course the most significant project completed during this period was Coyote Dam on the East Fork of the Russian River. This was a multi-purpose project that included flood control aspects and was completed in 1958.

Besides these Corps of Engineers improvements, the Bureau of Reclamation had built Trinity Dam above the town of Lewiston on the Trinity River, while local interests completed Ruth Reservoir on the Mad River.

Unfortunately for many residents of the District's North Coast area, they failed to grasp the significance of what had happened in 1955 and adopted a feeling that such a thing couldn't happen again for

*Now Federal Emergency Management Agency (FEMA).

at least another century. For, after all, the flood was labeled a "hundred year flood." So, in most cases they simply rebuilt their homes and businesses on the foundations that remained after the flood tide had passed.

The San Francisco District, however, began to monitor that area's streams more closely than in previous years, and established closer bonds with other agencies in the region, so that if danger visited the North Coast again, it would be ready. With each fall season, the District Engineer and his staff prepared plans for any emergency flood situation, always hoping that such prearrangements would not have to be effected. The fall of 1964 was no different.

The climate of California and southern Oregon is divided into definite wet and dry seasons. The wet season starts in September and continues through May. October 1964 precipitation varied from about normal over the northern portion of the state and southern Oregon to one-third of normal over the southern portion of the Russian River Basin. November precipitation ranged from three times normal over northern California and southern Oregon to twice normal over the Eel and Russian River areas. The November rains were more than sufficient to replenish the soil moisture and resulted in the first runoff of the winter season. The precipitation to December 18 maintained the saturated soil conditions. Besides the rain, substantial snow had accumulated at higher elevations of the Cascades and Coast Range, with the snow level at about 4,500 feet.

The storm of December 19-24, 1964, that hit northern California and southern Oregon, was of unprecedented intensity for so vast an area. In addition, the storm was accompanied by temperatures above the freezing level at high altitudes and extremely favorable antecedent precipitation conditions. These conditions resulted in producing catastrophic floods on most northern California coastal streams.

Over the weekend of December 19-20, District hydrologist Bill Tolton monitored the progress of the storm and began to note serious implications. On December 20, 1964, the Pacific high pressure system in the subtropics northeast of Hawaii began to deteriorate, allowing warm moist air from the tropics to move toward the Pacific Coast. As a result, a storm track 500 miles wide was established from the western Pacific near Hawaii to Oregon and northern California. Almost simultaneously a mass of cold air moved into the area from the Arctic. These two air masses met off the coast, intensifying the instability of the storm systems as they moved inland. The combined effect of moist unstable air, strong west-southwest winds and mountain ranges oriented perpendicular to the air mass movement produced record-breaking rainfall from December 21 to December 24. During this period the Eel River watershed received more than 22 inches of rain. In several locations, more than 10 inches were recorded during a 24-hour period.

The day before Christmas the storm began to taper off, but then on the 26th of December another frontal system moved through the area, leaving considerable snow above 1,500 feet and rain below that elevation. This went on until January 7, 1965, when a high pressure

system moved in and closed the storm door.

Meanwhile, District Engineer Colonel Robert Allan, after consulting with hydrologist Tolton, mobilized the District's flood emergency operation plan. On the 21st, the gates of Coyote Dam on the Russian River were closed. Early on the morning of the 22nd, the District's forces were mobilized for a flood fight and the flood emergency operations center was activated in the San Francisco District Office. Engineer field teams were dispatched to observe streams discharging into San Francisco Bay while others were sent north to the Russian River basin. They were to report on stream conditions and advise local governments in flood fight methods. Then the commercial airline serving Eureka was contacted for a charter flight. At 12:45 p.m. that same day, Colonel Allan and 15 key Corps of Engineers personnel and the Natural Disaster Coordinator from Regional Office No. 7, Office of Emergency Planning (OEP), left San Francisco International Airport for Eureka.

The plane landed at the Eureka-Arcata Airport at 4:00 p.m., under conditions the pilot considered worse than he had ever before experienced. Just as the flood fighting team arrived, a Coast Guard turbo-jet helicopter was taking off on a rescue mission after refueling; the aircraft and crew were reported missing two hours later and not sighted again until the day after Christmas. There were no survivors.

The San Francisco District established its Eureka project office in the Federal Court House building that evening and made contact with County officials. This entire action took place before any of the major streams had crested.

The insidious nature of the North Coastal streams was again evident in the flash flood characteristic which had already claimed portions of Sandy Prairie levee, constructed by the Corps on the Eel River at Fortuna, which was wrecked from the reverse sides, as were

Seven people died in the crash of this Coast Guard helicopter. Three of the victims had earlier been rescued from a flooded farmhouse.

Flood waters washed out a portion of the Northwestern Pacific Railroad near Scotia.

hundreds of miles of locally built levees in the Eel River Delta. Flood fight efforts were not possible in that area, however, owing to the lack of adequate levees and flood control measures on the rivers. Travel in the region was extremely difficult if not impossible. San Francisco District engineer teams dispatched to the Eel and Mad Rivers, and Redwood Creek were reporting conditions where it was possible to do so. The Mad River was flooding in the delta but the levee at Blue Lake was holding well. The Eel had isolated Ferndale, Rio Dell and Scotia, swept away major portions of Holmes Flat, Weott and Myers Flat and completely obliterated the town of Pepperwood. The Klamath River was soon to sweep the towns of Klamath and Klamath Glen into the Pacific Ocean.

During the early hours of December 23, the Mad River eroded a small section of the levee at Blue Lake. The damaged levee was inspected and a contract negotiated immediately with a local contractor to repair it. The flood fight continued through the night of the 23rd and 24th and was successfully completed the day after Christmas.

Through the night of Tuesday, the 22nd, and on into Wednesday, reports of flooding, evacuations, and damages were being compiled in the Flood Operations Center in the San Francisco District. Throughout the North Coastal mountain region, small communities were being isolated by flood waters. Major highway bridges were destroyed, cutting off access to the area from the north, east and south, which included all land routes. Heavy snow and wind conditions were knocking out power and communications lines. The storm was abating but continued to hamper or prevent air operations.

On December 24, 1964, President Johnson declared the 24 northern California counties a disaster area.* As principal Department of Defense Commander, the Commanding General, Sixth U.S. Army, answered the request of the Regional Director, OEP, sending vitally needed U.S. Army helicopters to aid in the search and rescue work. These were supplemented by 30 Marine helicopters aboard the aircraft carrier *U.S.S. Bennington*, which had been dispatched from Long Beach to lie offshore near Eureka to assist in these same operations.

*See Appendix E for a summary of damages to Northern California area.

Thousands of head of livestock were lost in the 1964 floods. Dead cows await burial south of Humboldt Bay.

Crescent City Harbor – 1964.

The town of Weott was completely under water during the 1964 flood.

As the flood waters receded, the magnitude of the task ahead became more evident. Thus, three additional field offices were established by San Francisco District: Crescent City; Weaverville — later moved to Yreka; and San Francisco, to handle the Russian River basin area.

On Sunday, December 27, Colonel Allan sent out a Corps-wide request for experienced personnel to assist the District in the monumental work that was ahead. By December 31, the first of 150 engineers began arriving in San Francisco for briefing and assignment to the field offices. They came from every corner of the nation — Los Angeles, New York, Buffalo, Huntington, Albuquerque, Chicago, Louisville, Kansas City, Omaha, Boston, Vicksburg and Galveston. Following their initial surveys and preliminary appraisal of flood damages, a program was prepared and put into operation for making a

detailed comprehensive survey of flood damages on the rivers and streams of the San Francisco District. Even while this aspect of the work was begun, the engineers undertook rehabilitation efforts. Within a year, operating under Public Laws 875 and 99, the San Francisco District completed over 575 projects, including flood fighting, flood emergency preparation, rescue operations, and repair and restoration of damaged flood control works. By December, 1965, San Francisco District had expended $24,350,000 on rehabilitating the region.

District contractors worked closely with public health officials in the accomplishment of all projects where public health and safety were concerned. These jobs included the disposal of dead cattle and other livestock and the removal of debris piles that contained rodents and reptiles.

Contracts were negotiated by the District to clear Crescent City Harbor and surrounding beaches, which were choked with debris and logs. This operation was mandatory for the safety of the city as well as for sea communications. The work included the removal and burning of debris and the salvage of all merchantable lumber.

In the Eel River Delta a Corps of Engineers contract with the local lumber companies initiated the salvaging of millions of board feet of lumber. The local lumber interests were formed into a corporation. "Delta Disaster, Inc." which cleared debris and salvaged usable lumber and logs under an arrangement in which the value of the reclaimed lumber was deducted from the contract. Logging contractors and mill personnel were used for clean-up operations, mitigating the unemployment situation.

San Francisco District contracts aided in the restoration of county roads, bridges and airfields. Hundreds of miles of streambeds were also cleared along with the restoration and repair of levees throughout the District.

The rapid and efficient accomplishment of these assignments was essential for the economic recovery of the region for obvious reasons. There was no transportation either within or to the outside of the area; lumber, constituting 70% of the economy, could neither be brought to the mills nor shipped, in finished form, to the market. Silt and debris covered farmland, homes and roads and imperiled the public health and safety. Under these conditions the economy was at a standstill.

The broad directive from OEP giving the Corps authority in these fields speeded the work immeasurably; the final factor enabling the District to begin immediate rehabilitation was the whole-hearted cooperation of county supervisors and agencies, based on mutual respect developed in the past. Another advantage was the existence in the area of a large number of contractors and their contracting equipment. As engineers fanned out into the stricken areas, they found small logging operators who could immediately begin work and, instead of being a burden on the economy, contribute to it. As animals were buried, debris removed, and county roads repaired, these contractors could be phased back into the lumber industry with

no check to continued employment.

These assignments were carried out concurrently by the San Francisco District and enabled the local people to again become employed and economically self-sufficient in a miraculously short time. In addition to employing under contract, regular construction firms and logging operators, the "Delta Disasters" set-up allowed the large lumber mills to use their own people in segregating their lumber, returning it to the mills, and beginning normal operation. Where there had been absolutely nothing — no roads, no industry, no employment — within weeks a functioning economy was restored. The work had, also, been extraordinarily diversified. Bridges of all types, for example, had to be repaired or rebuilt: log, timer, concrete, steel, even suspension. These contracts ranged from over $1,150,000 at Martin's Ferry Bridge to a few thousand in the case of numerous small stream crossings. At the same time as funds were being spent for public health and safety, and public utilities and airports, $10,000,000 was being spent to remove debris and wreckage — in an area-wide cleanup — and $5,000,000 on the repair of county roads and bridges.

The total damages resulting from the December 1964 floods in the San Francisco District amounted to almost $200,000,000.

During the 1960s several more large storm systems hit the Pacific coast, causing considerable flood damage. The storms of 1969 however, were particularly severe and will serve to further illustrate the terrible consequences of nature on the rampage and the role of the San Francisco District during these times.

Beginning on January 10, 1969 the first really large storm of the season struck the District, but was confined for the most part to the Russian River Basin, where Coyote Dam and its reservoir, Lake Mendocino, contained the flood flow as designed, thereby minimizing downstream damages. On the 18th of January, a new sub-tropical storm hit, followed by a companion storm on the 21st. The rain

Wreckage left by the December 1964 flood in Pepperwood along the Eel River before disaster recovery assistance by the Corps of Engineers.

continued almost unabated for eight days, with the central and southern reaches of the District getting swamped. On January 25, 1969, Governor Ronald Reagan requested that the President declare portions of California a major disaster area. The next day President Nixon declared 37 counties as disaster areas, thereby allowing P.L. 875 to be implemented. Upon the request of the Regional Director of Region 7, OEP, the San Francisco District began to mobilize its flood fighting efforts. That same day the Corps completed photo flights over the Salinas River Basin. On the 26th four teams of three Corps of Engineers "observers" were dispatched to the major river basins. Simultaneously a flood alter center was set up, and the South Pacific Division and San Francisco District Engineers made an aerial reconnaissance of the Salinas and San Joaquin Valleys.

By this time the Salinas River was on one of its worst rampages in modern history. Crop land was swamped, all sewer plants between Soledad and the Salinas River mouth were badly damaged. Most roads in the valley were under water. Some 30 families up and down the river were driven from their homes. Typical of rescues made at the time was the one carried out by a Coast Guard unit from Monterey, when it saved four people who had spent the previous night in a boat, tied to a snag in the middle of the river.

Local officials stated at the time that they were certain that the $6.5 million flood damages caused along the Salinas River in 1966 would be exceeded. They said they couldn't be sure, however, until the damage assessment team from the Corps of Engineers' San Francisco District, already at the scene, had filed their reports. As it turned out, Monterey county would suffer some $15 million in damages before the flood season was over.

The Salinas, Pajaro, Carmel, and almost all of the rivers in the central and southern portion of the District went out of their banks. Large Monterey County reservoirs (built by local interests) filled with water at record rates; Nacimiento had risen 85 feet in nine days, while San Antonio had risen 25 feet in the same period.

On February 23, a third storm pelted the region, this time pausing over the south central coast and then moving inland over the San Joaquin Valley. And even with the restraining forces exerted by Nacimiento and San Antonio dams, the waters passing through the town of Bradley surpassed all records in February 1969, with 100,000 cubic feet per second being measured. Near San Miquel, the longest bridge in the county was destroyed on the last day of the flood, forcing the residents to travel 58 miles to cross the street.*

The Corps of Engineers continued to monitor the situation, lend assistance where possible, and determine the full extent of the damage. It was estimated that agricultural damage from the January and February 1969 floods amounted to more than $17,000,000 and that total damages in the Salinas River Basin were set at $32,000,000. For their part, the Corps of Engineers, under P.L. 99 and 875, expended

District Engineer 1966-1969
Col. Frank C. Boerger

*See Appendices F and G for additional information regarding Salinas Basin flood damage.

almost $4,000,000 for repair of damage in Monterey and San Luis Obispo Counties. During the year that followed these floods, 33 contracts were awarded by the Engineers to put things back in order.

The January-February 1969 floods spread over the entire state and involved not only San Francisco District, but Sacramento and Los Angeles Districts as well. The cost of work for repair and restoration work in California, following the disaster of 1969 came to more than $27,000,000.

Part of these funds were used in "Operation Foresight," a flood preparedness program to deal with the eventuality of further floods, should the record snow pack melt too quickly. The storms that flooded the coast and Central Valley had left snow in the mountains that ranged from 190 percent of normal to 450 percent of normal. To plan for the worst, inspection teams from San Francisco District were sent to Siskiyou and Trinity Counties in California and to Klamath County, Oregon. A field office was established in Weaverville and, through coordination with county and local interests, the Engineers awarded several protective contracts. By these, levees and spillways were raised so that additional water could be stored and then channeled away safely. Fortunately, good weather prevented further flooding, but the preventive measures, at the cost of a few hundred thousand dollars, did their part as well in preventing millions of dollars in additional damages.

The above examples trace, but briefly, three of the dozens of storms and floods that have visited the District over the years. They are also illustrative of the emergency work undertaken by the Corps when called upon to mobilize its forces to save lives and property. But the San Francisco District has not, and does not, await disasters, before taking measures in the interest of flood control. Their primary efforts have been and remain, serious planning and construction of flood control and multipurpose projects that in and of themselves will either carry excess water away safely or store it so that it can be released at a later time to serve domestic, agricultural and industrial needs.

Flood Control Projects

The first flood control projects (other than emergency work) undertaken by the San Francisco District were the studies completed under the authorization of the famous "308" Reports of the late 1920s and the Flood Control Acts of 1935, 1936, 1937 and 1938. Investigated during these years were the Eel, Klamath, Russian, Napa and Salinas Rivers. Then during the 1940s, additional planning was authorized for Alameda, Alhambra, Corte Madera, Novato, Petaluma, San Francisquito, San Lorenzo and San Rafael Creeks. During the same period, surveys were authorized for the following

rivers: Big Sur, Carmel, Coyote, Guadalupe, Napa, Pajaro, San Lorenzo and Smith. Finally, during the 1950s, 1960s, and 1970s, authorization was received to study East Weaver, Pinole, Redwood, Rheem, Rodeo, Sonoma, Wildcat, and San Pablo Creeks.

Initial work completed was snagging and clearing of channels to facilitate the flow of flood waters, carried out during the late 1930s and 1940s. While additional work of this type was carried on into later decades, the District began to construct permanent flood control works which eventually led to the large multi-purpose dams put up and planned for in the North Coast region.

The first levee construction work completed by San Francisco District was the flood control project along the Pajaro River and its tributaries in the vicinity of Watsonville. The work was completed in 1949 at a cost of $748,000. Local interests provided lands, easements, rights-of-way and relocations for project construction, and have maintained the improvements since they were finished. The levee system was designed to provide protection from a floodflow having a frequency of once in fifty years, based on data then available.

The flood of 1955 and again in 1958 alerted the community in and around Watsonville to the inadequate protection offered by the levees. The discharge from these two floods came dangerously close to exceeding the channel capacity and the very real danger of levee failure. At a public hearing held by the District on April 9, 1958, a great deal of public concern was expressed by local interests who requested that the Corps restudy the adequacy of the levee system. The District shared this deep-felt concern, for it was subsequently determined that the existing project provided protection only up to the 35-year event. Because of the urgency, the Corps separated its study of the Pajaro River Basin into two parts. First and of immediate concern was the

Salsepuedes Creek.

study of the levee system at Watsonville and secondly the balance of the basin. The first part resulted in the 1963 Interim Report that recommended the upgrading of the levee system to a higher degree of protection. This recommendation was indorsed by resolution from both Monterey and Santa Cruz counties in June 1963. The Interim Report, together with the indorsed support by local government, was the basis for subsequent authorization by Congress to solve this serious flood problem.

Modification and extension of the existing levee system along the Pajaro River and Covialitos and Salsepuedes Creeks was authorized in 1966. While reconstruction planning for these improvements has been deferred, a flood damage prevention study of the Pajaro River is continuing. As of the summer of 1975, it was estimated that new improvements would cost almost $28 million.

Since its completion in 1949, the existing project has prevented flood damages of approximately $4 million in the Watsonville area. Even so the City of Watsonville and the extensive agricultural lands in the flood plain are still subject to severe damages during major floods. If and when the present project is modified, it will provide a high degree of flood protection to this area. If a project design flood should occur, the completed modified project would prevent flood damages of about $30 million.

Unfortunately, the Korean War broke out in 1950, causing civil works projects of the District to be set aside until the armistice was signed in 1953. And even with the end of active fighting in Korea, the available funds for flood control had to be shared with military construction being prosecuted during the post-Korean War period.

The first flood control project completed during that time was the small, but important, project on the north fork of the Mad River

Pajaro River cuts through a roadway.

near the community of Blue Lake, just a few miles northeast of Humboldt Bay. Completed in 1955 at a cost of $390,000, the levee was credited with lessening the impact of the massive flood that hit the area that year.

In 1958, a project known as the Butler Valley Dam and Blue Lake project was authorized by the flood control act of that year. As designed, the improvement consisted of a rockfill dam 350 feet high and 1,850 feet long to be built on the Mad River east of Eureka. The resultant reservoir would have a storage capacity of 460,000 acre feet. By controlling the runoff from about 70 percent of the drainage basin upstream from the dam,the project would provide a high degree of flood protection in the Mad River Delta. In addition to flood control, the project would provide about 160,000 acre-feet of water for municipal and industrial uses in the Mad River water service area, and offer extensive opportunities for water-oriented recreational activities. Due to the lack of support by local interests, however, the project was reclassified "inactive."

Just a year after the authorization of the Butler Valley Dam project, San Francisco District completed work on levees in the Sandy Prairie area, on the east bank of the Eel River near the city of Fortuna. The improvement consists of some four miles of levee, which has an average height of 25 feet, a mile of which was riprapped for slope protection. The federal first cost of the completed work was $680,000, and the non-federal cost was $300,000, contributed by local interests.

The project was modified in 1965 to provide for the construction of new levees and the modification of existing levees in the delta area of the Eel River and on the Salt River, and for the construction of a boat launching ramp and associated recreational facilities. Following some initial action, preconstruction planning for the 1965 modification was suspended and the levee additions placed in the inactive category in 1972. To date, the existing levees have prevented more than half a million dollars in flood damages.

Just as the initial work was being completed on the Eel River, similar, but more expansive work was being realized on the San Lorenzo River in the city of Santa Cruz. The river flows in a general southeasterly direction from the Santa Cruz Mountains through the city of Santa Cruz where it enters Monterey Bay. Branciforte Creek, a major tributary, joins the river from the south within the city. In the city itself, the river flows through a highly developed business, industrial and residential area that has been subject to damages from recurring floods. During the flood of December 1955, the most severe on record, damages were estimated at $7.5 million, a large part of which would have been prevented if the project had been completed and in operation at the time.

When completed in 1959 the flood control project comprised 17,000 linear feet of levees, a flood wall, 1.6 miles of channel work and other improvements within the city. Later in 1965 remedial work was done to the interior drainage system. Total cost of the project was $4.3 million, of which $2.3 million was contributed by local interests. Maintenance of the project is the responsibility of local interests.

Finally, the development of a basin plan of improvement will be considered under the Salinas-Monterey Bay Area urban study.

The following year, the San Francisco District completed work on another small flood control project. This was the Rheem Creek channel improvement work, designed to protect the Contra Costa County community of San Pablo—a town of some 20,000 located on the eastern side of San Francisco Bay. Authorized on June 12, 1956, by the Chief of Engineers, under provisions of Public Law 685 (84th Congress, 2nd Session) the project consists of channel improvement of Rheem Creek by alternate use of approximately 6,300 linear feet of trapezoidal earth channel and 1,500 linear feet of rectangular concrete channel. In addition, several new concrete box culverts and a new railroad trestle were built as part of the improvement. Riprap protection was provided at transition areas between earth channel and concrete channel, or culverts, and as an energy dissipator at a drop structure.

Federal cost of the project was $400,000, while the cost of meeting the requirements of local cooperation was some $190,000.

Two years later, during 1962, the San Francisco District completed a large flood control project about 20 miles to the southeast of the Rheem Creek work. This was the San Lorenzo Creek improvement. San Lorenzo Creek, which has overflowed its banks on several occasions and forced people to flee ahead of its turbid waters, flows through a highly developed residential area on the eastern side of San Francisco Bay.

Adopted as part of the flood control Act of September 3, 1954, and completed in February 1962, the project consists of a leveed channel extending about 1.4 miles upstream from the mouth of the creek where it enters San Francisco Bay; thence a rectangular concrete channel for a distance of approximately 7.3 miles; thence channel clearing and stabilization works to the head of the project—a total improved channel length of approximately 7.3 miles. This rather extensive improvement provides substantial flood protection to the communities of San Lorenzo and Hayward.

Total federal cost of the project was $5.2 million, while the cost of meeting requirements of local cooperation amounted to a million dollars. Local interests are not only maintaining the District's project, but have constructed other levees in the lower reach of the creek and have incorporated these into the overall project. For this, they were credited some $200,000, in lieu of providing a required cash contribution. Since its completion in 1962, the San Lorenzo Creek project has more than paid for itself by preventing flood damages in excess of $6 million.

Just six months prior to the completion of the work at San Lorenzo, the Chief of Engineers, again under provisions of P.L. 685, authorized a modest flood control project to protect the residents of Weaverville, county seat of Trinity County. Authorized on July 10, 1962, the construction was finished little more than a year later, in October, 1963. The improvement was comprised of some 2,200 linear feet of trapezoidal earth channel with riprap protection on side slopes and

channel bottom, 2,300 feet of riprapped levees, and 740 linear feet of setback-type levee with riprap protection.

The San Francisco District spent $200,000 for the work, while local interests contributed another $100,000. Since its completion, the flood control project has spared the community of Weaverville a lot of grief and an estimated quarter of a million dollars in damages.

It will be remembered that during the great flood of December 1955, several areas of Marin County lying to the north of the Golden Gate received extensive flooding. One of those areas was the town of Tamalpais Valley, located about eight miles north of San Francisco. Ten years after the flood, San Francisco District completed a small flood control project on Coyote Creek, consisting of about 7,500 feet of concrete-lined channel and trapezoidal section earth channel to protect Tamalpais Valley. Total cost of the work amounted to some $1.4 million, which was shared equally by the Corps and local interests. Just two years after its completion in 1965, the improvement prevented tens of thousands of dollars worth of damage, during the flood that struck the area in 1967. During the last decade, and more, the project has prevented thousands more in damages due to flooding.

In 1966, San Francisco District completed a pair of small flood control projects; one on Rodeo Creek, in the town of Rodeo, and another on Pinole Creek, in the town of the same name. Both improvements were authorized for construction on June 14, 1963 by the Chief of Engineers under privisions of P.L. 685.

The work at Rodeo was finished in January, 1966, and that in Pinole in April of the same year. Additional riprap work had to be done at Pinole due to erosion caused by flooding during the winter of 1965-66.

The Rodeo project consisted of 1,450 feet of rectangular concrete channel and 4,450 feet of trapezoidal earth channel. Similarly, the Pinole Creek work was comprised of trapezoidal earth channel riprapped as required extending about a mile and a half upstream from the mouth, with a pair of trapezoidal riprapped chutes to reduce high velocity flow, and rectangular concrete-lined sections under two bridges.

Pinole and Rodeo are both suburban residential communities located on the east side of San Pablo Bay. The cost of the project at Pinole totalled almost a million dollars, with the federal government paying $860,000 and local interests meeting requirements of some $120,000. The Rodeo Creek project was just a bit more expensive. Total federal cost was $990,000. The cost of meeting requirements of local cooperation was about $330,000. Though small and relatively inexpensive, these two flood control projects built by San Francisco District have played a sizable role in keeping residents dry during times of local flooding.

The last flood control project completed by the San Francisco District during the decade of the 1960s was that on Redwood Creek in Humboldt County. Redwood Creek drains an area of about 280 square miles and empties into the Pacific Ocean about 50 miles south of the California-Oregon border near the town of Orick. Floods in 1953, 1955

and 1964 caused damages of almost three million dollars along the course of this large creek.

The Redwood Creek project was adopted by the Flood Control Act of October 23, 1962. After almost four years of efforts by local interests and the San Francisco District, ground was broken for the Redwood Creek levee on Saturday, April 30, 1966, at Orick, California. Few events that took place in all of Northern California that year drew such a distinguished crowd. Congressmen, state senators, public works officials, Division of Highways engineers, and a host of other county and local dignitaries were on hand to help the work get under way. In addition, remarks were made to the gathering by Brigadier General Ellis E. Wilhoyt, Jr., South Pacific Division Engineer, and Colonel Robert H. Allan, San Francisco District Engineer.

State Senator Randolph Collier and Congressman Don Clausen, in delivering the major addresses of the day, each recounted the terrible suffering experienced in past years by residents of the area during the times that Redwood Creek and other North Coast streams went out of their banks to wreak havoc upon the people. With the completion of the project, people could sleep easier because their homes and businesses would be protected.

Two and a half years after the auspicious beginning, the improvement was completed in October, 1968. The project consists of levees, revetments, channel rectification, a pumping plant and appurtenant works along several miles of Redwood Creek near Orick. The federal cost of the work was $4.5 million. Local interests contributed $570,000 and still provide the maintenance of the project. It is believed that if the improvement had been in place prior to 1953, millions of dollars could have been saved in damages due to the floods that followed immediately thereafter.

Redwood Creek.

The first work of the 1970s was also done on the North Coast, in the vicinity of Klamath, California. Cities in the flood plain of the Klamath River near the ocean have suffered severe flood and erosion damage from winter storms. These cities include Klamath, Klamath Glen, Camp Klamath and Requa. The devastating flood of December 1955 caused damages in the project area of nearly $2 million. The December, 1964 flood inundated the town of Klamath to depths of up to 18 feet and almost completely devastated the project area. Damages were estimated at eight million dollars.

Authorized in 1966, the present project consists of a levee at Klamath and the construction of a new flood-free townsite at Klamath. The new townsite is protected by the filling of a 50 acre area behind a new freeway to the level of the freeway embankment. Local interests are for controlling development in the remaining flood plain, which has a land area of 2,200 acres.

In 1972 bank protection was finished along two miles of the north bank of the lower Klamath River, completing the entire project. Federal cost of the improvement totalled $7.8 million while local interests contributed $745,000.

The project prevents destructive flooding in the towns of Klamath and Klamath Glen, and results in annual benefits estimated at $860,000. The project also provides immediate and long-range benefits to the economy of the river basin due to increased employment opportunities and greater utilization of land protected from flooding.

The lower Klamath River is internationally known for its salmon and steelhead fishing, and the economy of the area is largely dependent on these activities. Due to the natural attractions of the area, it is expected that the annual recreation usage will increase to about 1.4 million visitor-days by the year 2000, and that the population of the flood plain will triple during the same period.

The next flood control work completed by San Francisco District was the small project on San Leandro Creek. The creek runs through areas devoted to residential housing, light industry and agriculture. Moreover, it forms the boundary between the cities of Oakland and San Leandro, and drains a 48-square mile area into San Leandro Bay, an arm of San Francisco Bay. Hence, schools, churches, and small businesses are also found along the banks of the creek.

The project is located in the lower two miles of the creek, and consists of improvements of about 1.3 miles of trapezoidal channel section and half a mile of rectangular concrete section. Construction of channel improvements was completed in 1973, at a cost of $1,285,000. Local interests contributed $285,000 of the total.

Four years following the work on San Leandro Creek, the San Francisco District completed the most expensive (other than multipurpose dams) flood control project in its history, on Alameda Creek. This large waterway which drains an area of 695 square miles, rises in the Diablo Range in Santa Clara County, flows northerly and westerly for about 40 miles and then empties into the southern end of San Francisco Bay near the town of Alvarado. Low lying areas in the

basin are subject to flood damages of major proportions; the floods of 1955 and 1958 alone caused direct flood damages estimated at between five and six million dollars.

To complicate matters, the Alameda Creek Basin has experienced an incredible population increase over the past decade, amounting to a growth of between 150 and 200 percent. Thus land use in the flood plain is rapidly changing from agricultural to urban, and additional water supply is urgently needed. Pumping from the underground basin has exceeded the natural recharge rate for the past 30 years, and has resulted in a lowering of the water table, posing a serious threat of saltwater intrusion.

Part of both problems, flood control and water supply, were solved when the State of California completed Del Valle Dam in 1968 as a unit of the State Water Project. The dam (and reservoir) derives its name from Arroyo Valle, the main tributary of Alameda Creek. The reservoir has a storage capacity of 77,000 acre feet and cost the state about $33 million. The Corps of Engineers contributed more than five and a half million to the dam and reservoir project, which reflected the flood control aspects.

The Corps of Engineers project was adopted by the Flood Control Act of October 23, 1962, and by the Water Resources Development Act of 1976, after several years of studying the stream basin and its recurrent flood problems. San Francisco District began looking at Alameda Creek with a view toward flood control as early as 1949. But it was the flood of 1955 that gave the needed push to local interests to request the Corps take definitive action. Preliminary reports for Congressional approval were under way during the late 1950s and early 1960s. With acceptance by Congress in 1962, Colonel John Morrison, San Francisco District Engineer, released the timetable for the project. He expected the design phase to be completed by December, 1964; design approval early in 1965; final plans and specifications, spring 1965; initial construction, 1966; and final completion in 1970. Colonel Morrison cautioned, however, that the date estimates were contingent upon congressional appropriations on an annual basis.

Dredge at work – mouth of Alameda Creek – 1973.

Due to conflicting views by local interests, inclusion of recreational facilities and a variety of other considerations, original plans and time schedules were modified. Even so, by the fall of 1965, a huge fleet of trucks, lightly loaded and equipped with balloon-type airplane tires, to avoid sinking into the mud, were working around the clock to finish the first stage of levee construction on the Alameda Creek flood control project. To avoid being shut down by winter rains, it was believed the initial phase had to be completed by November 1st. A complement of 25 truck-trailer rigs were being worked in two 10-hour shifts each day, hauling fill dirt from the upstream channel-widening project to the huge levees stretching two and a half miles out into the Bay and tidelands from the base of the Coyote Hills. When finished, the two long arms bordering an improved 400-foot wide channel held in the flood waters that annually turned some 15,000 acres of fertile flood plain land into a useless quagmire.

The entire project of levees, channel enlargement, bank protection and a recreational trail system along the coastal plain reach of the creek was completed in 1977 at a federal cost of about $21,000,000. And, to the all-important value of flood control provided the cities in the Livermore Valley, Niles Canyon, and the coastal plain reach of the creek, can be added the benefits of increased property values and public recreation.

The same Congressional action of October 23, 1962, that authorized the Alameda Creek project, also approved the Corte Madera Creek improvements for the Marin County communities of San Anselmo, Fairfax, Ross, Kentfield, Larkspur, Greenbrae, and Corte Madera. As envisioned by the original flood control act and modified by the act of November 7, 1966, the project provides for about 11 miles of channel improvements, including realignment, enlargement, levees, riprapping, rectangular concrete section, interior drainage

Rock being placed along Alameda Creek for flood protection.

facilities, bridge relocations, and debris removal on Corte Madera Creek and the lower reaches of its tributaries, and a continuous channel right of way to deep water in San Francisco Bay reserved to assure channel outlet in the event of future tideland development.

Few projects designed and constructed by the San Francisco District have resulted in as much controversy — especially when the very limited nature of the work undertaken is considered. By the fall of 1968, Marin County supervisors were unanimous in their desire to change the Corte Madera Creek Flood Control Project, so that an underground drainage would be built along Woodland Avenue in Kent Woodlands instead of concreting the existing Tamalpais Creek. While the Corps' stand, voiced by District Engineer Colonel Frank Boerger, would be to change their plan if the majority of those concerned wished it, the change would increase the cost of the project by about $100,000. Shortly thereafter, the Larkspur Chamber of Commerce voted to oppose changes in the Corte Madera project, unless Kent Woodlands residents were willing to pay the additional costs — which they weren't. Then on October 29, 1968 the Marin County Board of Supervisors, after several public meetings and a great variety of opinion being expressed, reversed their stand and told the District to go ahead with the original plan.

So with things back to square one, the engineers let contracts for the work. This was followed by protests from a few people that the work should not have been started so late in the season. Things were indeed slowed by the winter rains, but work progressed none the less, as weather would permit.

By early spring of 1969, however, residents (and unidentified persons from other locales) began to protest the project, especially the work being done on Tamalpais Creek.

The editorial page of the San Rafael, California *Independent*

The Alameda Creek project affords flood protection to thousands of homes.

Three flood victims row to safety over the waters of Corte Madera Creek.

Journal for March 14, 1969, contained an article that blasted the Corps' efforts. The San Francisco District was accused of using overkill methods and making no serious effort to find alternate plans to control flood waters. Marty Kent Jones, author of the article, stated that Tamalpais Creek was about to be mutilated and that Corte Madera Creek would suffer the same fate. To Jones, every inch of soil and nature had a value so infinite that it was beyond monetary considerations. It was pointed out how the average citizen felt helpless when matched against the power of an agency such as the Corps of Engineers, with the tax money and professional staff at its disposal. Marinites everywhere were beseeched to act to preserve the creek in its natural state. The next day a handful of protestors, led by Marty Kent Jones, brought a temporary halt to the work.

A month later, in mid-April, 1969, citizens, again led by Mrs. Jones, were out protesting the Corps' efforts. According to her, the creek would be better off dead than mutilated. Wearing a red, white and blue blouse with a golden eagle in flight upon it, and with her 11-year old daughter Alice at her side, she marched about decrying the project. At about the same time, several protestors planted themselves between a large yellow tractor and a loader and refused to move. For a moment-the tractor operator honked the horn — it looked as if one woman and a child might be run over since the operator couldn't see them in front of his machine. Then realizing that he couldn't solve the problem alone, he shut the tractor off.

A sheriff's deputy arrived momentarily, but decided to take no action until a Corps representative could come to the scene. The marchers rested up a bit, and then decided to go back to their first line of defense, Tamalpais Creek — whereupon the work was resumed. In addition to the adult protestors, some parents held their children out of school so that they could participate in "democracy in action."

By the 24th of April, Kent Woodland residents were charging

A resident surveys the rushing flood waters of Corte Madera Creek.

the Corps of Engineers with heavy handedness and insensitivity in planning of the concrete ditch to be erected for controlling floods on Tamalpais Creek. Colonel Boerger argued that alternative plans for the creek had been discussed time and time again, and stated that, in this instance, the proposed concrete-type structure was necessary. Boerger went on to say that one alternative would be to evacuate residents. He also explained that there would be very little visual loss of beauty to the four families who live on the creek. Concurring with the colonel was Donald Frost, head of the Marin County Public Works Department.

During the third week of April, U.S. Senator Alan Cranston asked that the Tamalpais Creek work be delayed until he could meet with Corps representatives to review the matter. General William Glasgow, South Pacific Division Engineer, Colonel Boerger and Cranston met in Los Angeles to discuss the proposals put forward to that time. With Cranston's approval, the engineers decided that the work should proceed.

Upon his return to the Bay Area, the District Engineer pointed out that unless Tamalpais Creek were included in the project, there would be flooding in College Park and on properties northwest of Kent Avenue. For purposes of review, he reminded area residents that phase one of the overall project had been completed and that phase two, between Bon Air and College Avenue bridges, was then being prosecuted. Phase three, the work to be done between College Avenue and Sir Francis Drake Boulevard, was scheduled to get underway in 1970.

Interestingly enough, two of the four residents whose homes border the tiny creek in Kent Woodlands were not opposed to the flood control project at all. One of the creek's residents wasn't upset about the Corps work, but was quite disturbed about the fact that recent demonstrations were not representative of the general feeling.

Tamalpais Creek prior to improvement.

Moreover, she didn't like all the pickets and "hippies" coming to the area to march about. On the other hand, two of the four residents didn't like the proposal as outlined, but preferred an underground drainage channel along Woodland Road.

Even so, on Monday, April 28, 1969, a group of adults and college students again with Mrs. Jones as spokesman, returned to the banks of Tamalpais Creek to try and stop the Corps work. Some put their feet under chain saws used to clear brush, others jumped into the creek, and several stood in front of an excavating machine.

Sheriff's deputies ordered the group to disperse, but no one budged. After awhile 15 law enforcement officers from the sheriff's department and the highway patrol moved into the creek and began arresting the demonstrators. Amid shouts by the college students of "pigs" and other less restrained epithets, the protestors were taken away.

Editorials in local and San Francisco papers following the latest incident seemed to reflect the feelings of the majority of Bay Area people at the time. San Rafael's *Independent Journal* editor suggested that the spectacle of young people ignoring the law, to endeavor to gain their will by bombast and demonstration, was not made pleasanter when they were led by their elders from the social upper crust. The editorials went on to remind readers that militant college students, who were long on criticism and pointing out hypocrisy of the middle and upper classes, were quite willing to be used for hypocritical purposes by members of the over-30 generation.

Reviewed also was the fact that only a year prior to the demonstrations, residents through whose estates the creek flows, thought so little of it that they proposed putting it underground, at public expense. And, according to the editor, the most interesting aspect of the controversy was that, the importance of the little stream increased with the distance from it. For, the newspaper received a letter from Palm Desert, wherein the writer decried the destruction of the creek and urged that water should be controlled where it falls by seepage basins and reforestation of the bare and eroded landscape.

From Washington D.C., Senator Cranston issued a statement berating the Corps for uprooting trees and laying a concrete ditch where the beautiful Tamalpais Creek once edged its way along the Marin countryside. It seemed to the editor that the Corps detractors had forgotten how local officials had worked for years to get federal aid to stop the recurring floods that forced families from their homes in the College Park area and other nearby neighborhoods.

The editor admitted that he was no admirer of the Corps' affinity for concrete as the one and only building material, nor of the overkill mentality that makes the Corps design all projects for 100-year floods. He went on to say, however, that to pretend that putting a concrete ditch 10 feet wide and 13 feet deep for 400 linear feet of Tamalpais Creek was major desecration of the environment was nonsense.

Similarly, the *San Francisco Examiner* of April 30, 1969, suggested that the need for flood control could not be seriously

questioned and gave the protestors, who placed themselves in front of the contractor's equipment, very low scores in citizenship. Again, the protestors were reminded that they had had ample opportunity to redress their grievance through legal channels, failed to act responsibly, and then belatedly chose civil disobedience. The *Examiner* believed that, far from being the villain in the matter, the Corps of Engineers had been profligate in dispensing information to all concerned about its plans. The controversy, according to the *Examiner*, resulted not from the obdurancy of the Engineers, but from a lack of foresight and vigilance in Marin County.

A month after the April demonstrations, attorney Roger Kent filed a court action on behalf of the Kent Woodland Property Owners Corporation and Dr. and Mrs. Samuel Hanzel, whose property borders the creek. Work was stopped at 11:00 a.m., May 19, 1969, on the Tamalpais Creek portion of the Corte Madera Creek Flood Control Project with the serving of a temporary stop work order on the contractor. By May 23rd, after rains visited the area and vandals wrecked two pumps on the creek causing it to flood, the stop work order had cost the taxpayers an estimated $50,000. Unfortunately, because of that order, the Corps couldn't even enter the area to repair the pumps.

Nine days later the stop work order was lifted. Soon thereafter the Marin County Board of Supervisors voted 4 to 1 to urge the Corps of Engineers to finish the work on Tamalpais Creek with all deliberate speed. By the summer of 1969, the Tamalpais Creek work was pretty well complete and a large portion of the Corte Madera Creek flood control improvements were substantially underway.

San Francisco District personnel inspect work being done on Tamalpais Creek.

Presently, the project is about 53 percent complete; the remaining work to be done consisting of design and construction of the remaining 3,000 feet of channel downstream of Sir Francis Drake Boulevard and Ross Creek. In lieu of the authorized concrete channel, an alternative plan consisting of wing walls and individual house flood proofing is being considered. That portion of the project upstream of Sir Francis Drake Boulevard is indefinite due to lack of local support. Finally, completion of the project has been delayed until after 1980, to allow further time to study a variety of other alternatives to those improvements already authorized.

Tamalpais Creek – 1980.

Multi-Purpose Projects

San Francisco District has completed one major multipurpose dam to date and is presently well into the construction phase of another. Both dams are located in the Russian River Basin. The first, Coyote Valley Dam, which backs up Lake Mendocino, was adopted by the Flood Control Act of May 17, 1950 (modified by act of October 23, 1962).

Major floods have visited their wrath upon the residents of the basin in 1861-62, 1877, 1885, 1889, 1893, 1903, 1909, 1911, 1925, 1937, 1946, 1950, 1955, 1958, 1962, 1963, 1964 and 1965. Unfortunately much of the damage caused by floods on the Russian River was the result of early efforts to build up and stabilize the flood plain. This was so because, in their attempt to improve conditions by planting willows and other deeply rooted trees, the farmers actually contributed to the

river's tendency to flood them out. While building up the plain, the willows also acted as debris collection agents, which created log jams, causing the swift and swollen stream to cut away its banks and eventually overflow them.

Poor timber harvesting practices and the overgrazing of hillsides also contributed to the flood situation. Unprotected soil washed into the streambed, causing it to rise, which in turn produced higher flood levels. Finally, inadequate stream crossings, unsound drainage practices, when coupled with the above and the natural lay of the land, have caused a great deal of human suffering and tremendous economic disability to the region.

Isolated, local attempts to stem the flood tide were tried on a piecemeal, year-to-year basis, with little success. Individually constructed levees and bank protection works simply could not stand up to the river's overwhelming power and constantly changing course. Hence there was an obvious need for basin-wide measures to control floods, but the expense and coordination of so large an effort were quite beyond the means of the local residents.

Following a series of damaging floods in the 1930s, local interests began to organize their efforts to secure relief from state and federal agencies. While the state could offer little but emergency funds to repair existing works, the Flood Control Act of 1936, as amended the following year, opened the way for the development of a long-term solution to Russian River floods.

On September 13, 1938, Colonel J. A. Dorst, San Francisco District Engineer, held a public hearing in Santa Rosa to discuss basin-wide flood problems with concerned local interests. Contrary to a study conducted by the Russian River Flood Control Association, which contended that construction of large storage reservoirs was not physically possible nor economically feasible, Colonel Dorst stressed that such dams were essential if the river was to be controlled. He ended the hearing by asking for the required local assurances of cooperation, which amounted to donation of enough land on which to construct the project, and the maintenance and operation of the works once completed.

Hearing no serious objections to the conditions, and after explaining the process by which federal involvement could be secured, Dorst and his staff returned to San Francisco where they began work for the studies needed to get things moving. After considerable field work, the District completed preliminary studies on May 18, 1939.

During the summer of that same year, the Chief of Engineers ordered a full scale survey of the Russian River Basin relative to flood control. In the course of the investigation, a model flood, which exceeded the severity of any on record, was developed on paper. On the basis of data extracted, it was concluded that a project for flood control alone could not be justified. Therefore the survey was expanded to consider a dual purpose project, which added the aspect of water conservation to flood control plans.

As a result of the survey, the Engineers proposed the

construction of two dams, one to be located on Dry Creek, and another on the East Fork of the Russian River. The addition of water conservation to the overall project illicited strong support from the recreation interests of the lower reaches of the river, concerned as they were with reduced stream flows in the summer due in large measure to increased upriver irrigation. Because of the active support of the Russian River Recreation Association, the District specified in its report that a minimum flow of 125 cubic feet per second (cfs) at Guerneville was necessary to maintain recreational facilities.

The final report of the District was submitted to the Board of Engineers, who returned it to San Francisco in June, 1941, with a negative recommendation. The Board questioned the validity of water conservation benefits relative to the financial participation of local interests. Moreover, the Board of Engineers desired additional information on this issue, and clarification of other aspects of the report. With the negative findings, and the advent of the Second World War, Russian River flood control planning was temporarily suspended.

During the summer of 1944, local interests, with the support of both the Pacific Division Engineer, Colonel Edwin Kelton, and San Francisco District Engineer Colonel K. M. Moore, requested authority to re-examine the area. Hard on the heels of their request came the monumental Flood Control Act of 1944, which allowed for the consideration of on-site recreation as a calculable benefit of reservoir construction. The act breathed new life into the Russian River plan.

San Francisco District and representatives of the Bureau of Reclamation, who were then conducting their own study, held another public hearing in the summer of 1945 relative to basin-wide development. As happened at the 1938 hearing, local testimony favored levees and channel improvements over large storage projects. Farmers reasoned that dams would cause inundation of agricultural lands, and reduce the value of other farm acreage because reservoirs would saturate soils in project areas. There was as well a general concern about the geologic instability of possible dam foundation sites. On the positive side, some favorable remarks were made in support of dams, just as long as they were put up in the higher elevations near the headwaters of the rivers.

Following the latest hearing, San Francisco District conducted a series of in-depth studies from 1945 through the summer of 1948. On September 9, 1948, their report, entitled *Survey Report on Russian River, California for Flood Control and Allied Purposes* was finalized. The comprehensive study identified three major issues of the basin:

1. Flood damage, principally affecting agricultural lands, and secondarily, population centers, highways, bridges, residences, and other areas.
2. Insufficient water supplies for a rapidly expanding population.
3. Limited downstream flows due to increased up-river irrigation.

In large measure, the situation existed because of the area's seasonal rainfall, which produced too little, if any, water in the

summer and drenched the basin during winter months.

San Francisco District proposed a double-edged plan to solve the identified problem:

1. Channel stabilization works from the river's mouth to the community of Calpella, and on the lower reaches of major tributaries.
2. Construction of two dams (and reservoirs) to conserve winter run-off for flood control, provision of local supplies, export to the Bay Area, and the maintenance of minimum flows for recreation.

The first reservoir planned for construction was to be a two-stage, multipurpose project, designed to impound 199,000 acre feet of water, on the East Fork of the Russian River in Coyote Valley. The second was another multipurpose dam/reservoir, which would store 216,000 acre feet of water on Dry Creek, the largest of the river's tributaries.

The first stage of Coyote Dam would have a total storage capacity of 122,000 acre feet; 48,000 for flood control; 70,000 for conservation and storage to provide releases for domestic, industrial, and agricultural uses, and for augmentation of summer flows; and 4,500 for siltation. Construction of the first stage was estimated to cost sixteen and a quarter million dollars, with maintenance running at about nineteen thousand per year.

The proposed improvements were expected to meet all local needs and potential irrigation requirements for some 48,300 acres. Other benefits to be derived from the new work included improved fire protection, recreational development, and improved fish and wildlife habitat as a result of better stream flows. Finally, it was perceived that because a dam would afford substantial flood protection, property values would appreciate, and new lands could safely be developed.

The Coyote Valley project required financial participation by local interests to the tune of 57.4 percent of the first costs of the work, but not to exceed $9.3 million. Eventually this was modified to 60 percent of the costs of conservation and storage benefits payable in a lump sum of $5,578,000. The California State Department of Public Works, Division of Water Resources, offered to assume the costs of acquiring lands, easements, and rights-of-way for the channel stabilization works. At the same time, supervisors of both Sonoma and Mendocino Counties passed resolutions in support of Coyote Dam and the channel work, but reserved the right to make a decision on the Dry Creek project at a later date.

Just as plans for the basin-wide project were sailing along smoothly and were headed for Congressional approval, a major conflict developed among local interests over rights to Russian River water. Dissension, which had been brewing for some time, stemmed largely from the intensified use of upstream water for irrigation to the detriment of downstream recreational users. It didn't help matters that upstream agricultural interests were Mendocino county residents, and downstream recreational interests were Sonoma County

residents. Before long Mendocino County became rather wary of Sonoma County's intentions toward what it considered native water.

After a great deal of fist-pounding, charges, counter-charges, and mistrust being aired, the supervisors of both counties put local issues aside (for the most part) and agreed to work together. By 1955, the reality of Coyote Dam rested with the voters of Sonoma and Mendocino Counties. Just prior to the elections that would determine local support, a Congressional hearing was held in Washington D.C. on May 3, 1955, to deal with the assignment of federal funds to the project. Delegates from both counties attended and testified relative to the pressing need for the construction of Coyote Dam. When the hearing was over, it was decided to withhold federal funding until local monies had been committed.

On May 10th, Sonoma County voters approved the measure by a 3 to 1 margin, assuring construction of the dam. Six months later, however, a taxpayer's suit was filed in Santa Rosa Superior Court by opponents of the Coyote Valley projects. The effect of the action was to halt the delivery of Sonoma County's $5.6 million bond issue to the Bank of America which purchased the bonds in December of that year. To further complicate matters, the Sonoma County Treasurer refused to sign the bonds on the grounds of pending litigation. For the moment, at least, the project came to a standstill.

To allay fears that residents would have to pay increased (inflation caused) construction costs, local Congressman Herbert Scudder authorized a bill to expand the federal appropriation for Coyote Dam from $11,522,000 to $12,687,000. The bill was passed by the House on January 11, 1956.

After making the rounds of the Sonoma County Superior Court and the California Supreme Court, the Third District Court of Appeals in Sacramento ruled the taxpayer's suit devoid of merit. Two weeks later, despite foul weather and a relatively low turnout, the voters of Mendocino county passed their bond measure by a 3 to 1 majority. And while the construction of the dam was assured, the exact amount of water that was to be guaranteed to the respective counties remained an unsettled question. In fact, as of January 1979, parts of the issue had still not been decided.

On March 1, 1956, the Bank of America took final delivery on the bond issue from Sonoma County. Shortly thereafter the taxpayer's suit was dropped, and the way cleared for construction to begin.

Construction bids were solicited in two parts; one for the construction and installation of three gates; and secondly for labor, materials and equipment for an earthfill dam, including outlet works, spillway, intake channels, project offices, access roads, utilities and appurtenant works. In both instances the low bidder was the Guy F. Atkinson Company of San Francisco, which was awarded the entire contract on June 16, 1956.

Ground breaking ceremonies were held on July 24, 1956, at the west end of the dam site adjacent to Highway 20. The dam, excepting the Zone C impervious core, was constructed by compacting 8-inch layers of material, dampened to the proper moisture content, with

Coyote Dam – Lake Mendocino.

four passes of a 50-ton rubber-tired roller, pulled by a tractor. Zone C required a different method of construction. The procedure and special type of processing equipment necessary for it were determined by a test fill developed prior to the award of contract. Highly consolidated clayey material from the spillway excavation area was dumped and spread on the embankment. The chunky material was then reduced to 6-inch maximum size by making two complete passes with sheepsfoot rollers. In this initial breakdown, any oversized chunks at the bottom of the layer were lifted by scarifying the full thickness of the layer. Then moisture was applied to the material in the embankment and was mixed with it for the full depth of the layer by making two passes with a "Rome" disc harrow. Final compaction was achieved by making eight complete passes with the sheepsfoot rollers. Moisture was applied throughout the final compaction phase.

The material used to form the embankment was taken from sites in Coyote Valley. The quarry source of the riprap was located 7 miles east of the dam site. Borrow Areas 1, 1a, and 2, located in Coyote Valley on both sides of the East Fork, were the sources of Zone B material. Borrow Area 4, on the south tip of the embankment, was the source of Zone A material. The spillway area was the source of Zone C material.

The construction of the dam was supervised by Charles F. Beatie, Project Engineer. Prior to his association with Coyote Dam, he had worked, on and off, for the Corps of Engineers for some 17 years. To aid Beatie in his work were an Associate Project Engineer and a half dozen field inspectors. With these supervisory personnel, the Project Engineer was able to accomplish full inspections of the construction work at all times. In addition, a field soil laboratory chief and five engineering aides tested soils on-site for gradation, moisture content,

and density. At the same time, a survey team with four members checked grade and slope controls and prepared beginning and final cross sections. An office engineer, with the assistance of a computer-draftsman and inspector, figured quantities for payment and maintained "as-built" drawing.

Even as the dam was under construction, four miles of channel stabilization was completed near Guerneville in February, 1957. The dam itself was completed in April, 1959, and dedicated, along with Lake Mendocino, on Saturday, June 6, 1959.*

Coyote Dam is a compacted, impervious, earthfill embankment, with a crest elevation 784 feet above sea level. Crest length is 3,500 feet and crest width is 20 feet. Its maximum height above the stream bed is 160 feet. The outlet works are located near the center of the dam and consist of a single concrete conduit 1,000 feet long and 12.5 feet in diameter, with three rectangular gates, each 5 feet by 9 feet, housed in an intake tower. An approach channel, a concrete exit portal and a discharge channel complete the works. The discharge capacity of the outlet is 6,500 cfs at the bottom of the flood control pool.

The spillway is cut through the left rim of the reservoir about three-quarters of a mile upstream from the dam site. It discharges into Howard Canyon, which enters the main Russian River about a mile and a half downstream from the confluence of the East Fork and the Russian River. The spillway consists of an approach channel, a broad,

Coyote Dam.

*For additional information see Appendix D.

crested concrete weir, chute, flip bucket and exit channel. The crest has a width of 200 feet, situated some 765 feet above sea level. Its discharge capacity at the elevation of maximum flood water surface is 30,200 cfs.

Even before the dam was completely finished, San Francisco District, early on, realized that the new reservoir was going to be a major recreation facility. To facilitate development for this purpose, and to promote optimum and safe use of the reservoir by the public, the District submitted its *Master Plan for Public Recreation Development* in January, 1959. In addition, the Corps made some initial improvements for the convenience of visitors. In the main, however, the plan as submitted envisioned the development of recreational facilities by the County of Mendocino.

While the County constructed additional facilities, it invited proposals from private capital for the development of concessions. A group of Ukiah businessmen, operating as Mendoyama, Incorporated, won an agreement with the County to build and operate concessions on the lake. Difficulties ensued. After some eight years of failure to comply with established and agreed upon federal rules and contractual arrangements, the U.S. Marshall, utilizing Corps personnel, had to physically remove the concessionaires' property.

From 1966 to the present, the Corps has had full responsibility and jurisdiction for the design and implementation of the recreational

District Engineer 1969-1972
Col. Charles R. Roberts

Quiet waters of Lake Mendocino.

program at Lake Mendocino. Their work has proceeded steadily with only the normal impedences of weather and budget considerations. Today the San Francisco District operates more than 5,000 acres of recreational facilities, including 1,700 acres of lake surface and 15 miles of shoreline. Boat ramps, camp sites, lawn areas, fueling facilities, a snack-bar, playgrounds, barbeque pits, bathhouses and a variety of other Corps improvements make the project area especially desirable and accessible for outdoor, recreational-oriented activities.

In addition to the physical improvements made by San Francisco District at Lake Mendocino, there are a full range of supervised activities sponsored by the Corps throughout the year. Twice each week during the summer months campfire programs are held, which include slide shows, guest speakers, and demonstrations emphasizing environmental themes. Guided tours of lake facilities and nature trails are also available, as well as a Career Day designed especially for local high school students. There are bike rodeos, scouting activities, water skiing demonstrations, parachuting and hang gliding. Lake facilities are used annually as a staging area for a long-distance, endurance horse ride.

A rather unique activity is the special observance of Native American Day, held to pay tribute to the Pomo Indians, and their lasting contribution to the region. Associated with this is the plan for a Cultural-Interpretive Center at Lake Mendocino, developed by San Francisco District in conjunction with the Mendocino Pomo Council, a Native-American organization, to promote American Indian heritage and culture, and to serve as a visitor information center for the entire project.

In addition to facilities and activities relative to recreational and cultural interests, San Francisco District has also sponsored a number of on-site studies to enhance the understanding and appreciation of the area. These include:

1. A joint research effort with the U.S. Forest Service to evaluate the most suitable plant life for the area. Assisting the federal agencies was the University of California at Davis.
2. A major study of the historical and cultural resources of the project area, which will form the basis of the themes and displays housed in the Interpretive Center.
3. A study dealing with the effects of fresh water inundation on cultural materials. During 1976-77 a severe drought caused the level of the lake to drop significantly, exposing cultural and archeological sites that had been under water for almost 20 years. Examination of the sites and associated artifacts provided new information on the condition of inundated archaeological materials and innovative methods of site conservation were developed to be applied to other dam projects.

In total, Coyote Valley Dam and Lake Mendocino represent the fruits of combined labor, are illustrative of responsible planning and reflect a sensitivity on the part of the Corps to the needs of those who have lived on the land for millennia and to those who will spend but a few hours in the area.

District Engineer 1972-1974
Col. James L. Lammie

Lest we not forget its overriding purpose, the dam and lake provide a high degree of flood protection in the Ukiah and Hopland valleys, and a lesser degree of security to areas further downstream. The project also provides urgently needed water supply for irrigation and the growing urban and suburban areas. Planned releases are made to augment normal streamflow during the summer months which permit continuing use of downstream recreation areas. Releases for water conservation purposes are made according to requirements of the Sonoma County Flood Control and Water Conservation District.

Federal cost of the Coyote Dam and Lake Mendocino Project, including bank stabilization work, was $15,400,000. Local interest cost for sharing in the project was $5,800,000. In addition, local interests have spent about $10 million for water distribution facilities and $1 million for partial flood control work in project areas. The Corps of Engineers maintains and operates the dam and lake, while local interests maintain the channel stabilization works.

Lake Mendocino was the first phase of a comprehensive plan of development for the Russian River. The Warm Springs Project located on Dry Creek and the Knights Valley Lake, respectively, comprise the second and third phases of the comprehensive plan.

Knights Valley Lake, a multipurpose project in the drainage areas of Franze and Maacama Creeks was authorized in 1966, and comprised three-stage construction of two dams that would create a 1,500,000 acre-foot capacity lake for flood control, water supply and recreation. Water conveyance facilities also made up a part of the work. Due to lack of local supports, however, the project was recommended for deauthorization in 1976 and was formally deauthorized in 1977 under provisions of Section 12 of the Water Resources Development Act of 1974.

Warm Springs Dam

District Engineer 1977-1980
Col. John Miley Adsit

In mid-June, 1970, the first major contract award for the Warm Springs Dam and Lake Sonoma Project went to the Piombo Corporation of San Carlos. The $4.8 million contract called for the relocation of four and a half miles of road east of Cloverdale and Healdsburg, and for foundations for a bridge that would eventually span an arm of the completed lake. With the award of this contract, the long awaited project got underway.

The project was authorized by the Flood Control Act of 1962, Public Law 87-874, approved October 23, 1962, by the 87th Congress, 2nd Session.

The dam itself is (when completed in 1983) a rolled earth embankment, located at the confluence of Dry Creek and Warm Springs Creek, in the Russian River Basin, five miles west of Geyserville, about 14 miles northeast of Healdsburg and 70 miles northwest of the San Francisco Bay Area. The crest elevation will be

Grading gets underway for the new dam.

Officials from the District and the Auburn Construction Company broke the earth for the Warm Springs Dam project on June 2, 1978.

519 feet above sea level, with the top of the dam only six feet above the maximum water surface in the reservoir. Curved on a 6,000-foot radius, the dam crest will extend approximately 3,000 feet across the stream channel and measure 30 feet wide. The upstream face of the dam will be covered with rock for protection against wave action. The downstream face will be covered with six inches of topsoil and seeded. The embankment design is based on a thorough evaluation of the effects of existing faulting and shearing, on the strength of the foundation bedrocks; on the maximum credible seismic event which may be expected at the location of the project; and on the interaction of the embankment, foundation and reservoir after the dam is completed.

A pervious filter blanket under the entire downstream half of the dam, connected to a pervious inclined drain extending the full height and width of the downstream side of the impervious core, has been included as positive seepage control and in addition provides increased safety for possible earthquake effects. Seepage control measures will also include an impervious core extending to bedrock below the embankment, a curtain of cement grout injected in the rock in the foundation and abutments, and a small drainage tunnel in the ridge forming the left abutment of the dam.

The major portion of the embankment material is coming from a borrow area located on a hilltop overlooking the north abutment of the dam. Impervious fill material is being taken from a borrow area located within the reservoir area just upstream for the dam, from foundation excavation, and from required slide removal. Gravel is being obtained from the channel of Dry Creek within the reservoir area. Excess material from road and spillway construction in the vicinity of the dam is also being used for embankment. Altogether, some 30 million cubic yards of embankment material will be needed.

Warm Springs Dam will create Lake Sonoma, with a capacity of 381,000 acre-feet at spillway crest elevation (495 feet above sea level).

Conveyor belt at Warm Springs Dam project-May 1981.

Of the total capacity, 130,000 acre-feet will be allocated to flood control, 212,000 acre-feet to water conservation, 26,000 acre-feet to sediment accumulation during the 100-year economic life of the project, and 13,000 acre-feet for maintenance of a minimum pool. With the water level at the spillway crest, the lake will have a surface area of 3,600 acres, extend 12 miles up Dry Creek and 7 miles up Warm Springs Creek, and provide 73 miles of shoreline.

Water will be released from Lake Sonoma downstream to Dry Creek via a multiple level outlet works in the left abutment. There will be four intakes located at elevations 221, 350, 390 and 430 feet above sea level. At maximum pool elevation, the outlet works will be capable of discharging 8,040 cfs.

A spillway will be constructed in a natural saddle on the ridge forming the north abutment of the dam. The spillway has been designed to discharge approximately 29,600 cfs with a depth of flow over the spillway crest of 18 feet. The spillway will discharge into Dry Creek downstream of the outlet works stilling basin. Maximum downstream releases, under spillway design flood conditions, could approach 38,000 cfs.*

To construct the project, San Francisco District found it necessary to relocate certain existing features. Some of these relocations have already been completed, either partially or in full. These relocations include:

1. Three bridges and 24 miles of county roads passing through the reservoir area.
2. Approximately 15 miles of electrical power line and 9 miles of telephone line.
3. Five tracts of land consisting of Skaggs Springs Cemetery, the Pritchett Family Cemetery, and three individual grave sites.
4. Four bench-marks installed by the U.S. Coast and Geodetic Survey.

*For a statistical summary of project data, see Appendix I.

Based on current and projected population expansion and the growing need for outdoor recreation, as indicated by existing lakes, initial recreational facilities have been designed to accommodate an annual visitor-day attendance of 1,000,000, with provisions for future expansion to accommodate an ultimate attendance of 1,500,000. Initial recreational facilities will be located in eight major recreation complexes and in several remote sites around the perimeter of the lake. The initial phase of development will provide overnight and day-use facilities for camping, picnicking, fishing, water sports, hiking, horseback riding, sighseeing, nature study and interpretive activities.*

Special consideration has been given to the protection and enhancement of fish and wildlife, by the San Francisco District relative to the Warm Springs project. A two-stage stilling basin will be constructed at the downstream toe of Warm Springs Dam. A 14.5-foot diameter tunnel from the outlet will discharge into the first stage of the stilling basin. A weir separating the primary and secondary basins has been designed as a barrier against fish swimming upstream in Dry Creek and will create a relatively tranquil condition within the secondary or downstream basin. Flow will be routed around the weir end to attract fish to the fish ladder which will originate in the secondary basin.

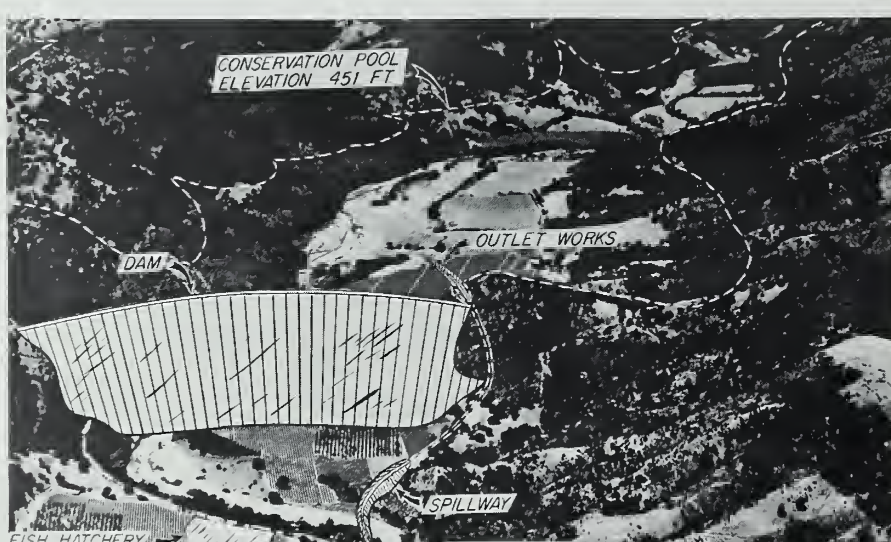
The estimated present annual anadromous spawning migration in the total Dry Creek drainage is 8,000 steelhead trout and 300 coho salmon to spawning areas. Since Warm Springs dam will block the annual upstream migration of about 6,000 of the steelhead trout and 100 of the coho salmon to spawning areas, a fish hatchery is being constructed as part of the project to mitigate the fishery losses which might otherwise occur. The hatchery will also be utilized for the development of a chinook salmon fishery, an enhancement of existing conditions.

To compensate for loss of wildlife habitat resulting from filling Lake Sonoma and for the 180 acres of additional habitat that will be

*For a summary of construction contracts let to date, see Appendix J.

Overlay shows how the dam will fit into the Russian River Basin.

District Engineer 1974-1977
Col. Henry A. Flertzheim, Jr.



taken for roads, parking spaces and similar permanent features, a wildlife management area will be established on approximately 3,200 acres of land located adjacent to the reservoir in the Pritchett Peaks area north of dry Creek and south of Kelly Road. San Francisco District has developed a program to improve habitat for deer, quail and other wildlife species in the management area.

Additional information was brought to the District regarding an endangered species coming under the Endangered Species Act of 1973. It seems that a portion of the proposed habitat zone, which contains a breeding site for peregrine falcons, falls within the project boundary. The project will not destroy or even modify the site, and the management of the land will be designed to insure the protection of the area. Close coordination is being maintained between San Francisco District, the U.S. Fish and Wildlife Service, and the California Department of Fish and Game. In keeping with the Endangered Species Act, the location of the habitat area will not be released to the public until management of the area is initiated. Finally, the San Francisco District will continue to coordinate with the California Department of Fish and Game, and the U.S. Fish and Wildlife Service in any reevaluation of the fish and wildlife mitigation features.

Though supported by the vast majority of residents and local officials, Warm Springs, like so many other government-sponsored improvements of recent years, has had its detractors. In the main these groups either protest the economics, environmental or historical aspects of a given project. In the case of Warm Springs, the work, before and during its construction, was attacked upon all these grounds.*

San Francisco District, in compliance with the National Environmental Policy Act (NEPA) of 1969, filed in December, 1973, a final environmental impact statement (EIS) for the Warm Springs Dam and Lake Sonoma Project. The purpose of the EIS was to provide a complete description of the project and the environmental setting

*For a summary of legal events regarding the Warm Springs project, see Appendix K.

Warm Springs Creek Bridge construction started on W.S Bridge in the fall of 1972 and was completed in Oct. 1973. Length: 1598 feet with the 600-ft center span weighing 900 tons.

within which it would be constructed, and to analyze the impacts, both beneficial and adverse, of the work upon the environment. An analysis of alternatives to the proposed project was also included.

Having survived local pockets of opposition and the by-now-usual student protests, the work was finally undertaken in the summer of 1970. Shortly after the District's EIS was completed, however, a complaint was filed with the Federal District Court alleging inadequacy of the project environmental impact statement by the Warm Springs Dam Task Force, et al, on March 22, 1974. After studying the issue, the Court, on May 23, 1974, denied the plaintiff's request for an injunction and ruled that the Corps of Engineers' environmental impact statement was adequate. District Court Judge Williams did, however, retain jurisdiction of the archeological aspects of the suit. One of the plaintiffs, pending hearing of an appeal to the U.S. Ninth Circuit Court of Appeals, requested Supreme Court Justice William O. Douglas to intervene. On May 30, 1974, Justice Douglas granted a temporary stay of construction on the project, dependant upon his review of the case. Then on June 17th, he continued the stay to maintain the status quo, pending a decision by the Court of Appeals. A hearing on the appeal was held on February 11, 1975. On August 19, 1975 the Appellate Court remanded the case to the District Court for a review of the additional studies then being conducted by the Corps in the areas of cultural resources, seismicity and water quality.

Archeological investigations of the Warm Springs project were completed in accordance with the terms of a Memorandum of Agreement which was signed in May, 1974, by San Francisco District, the Advisory Council on Historic Preservation (ACHP), the California State Historic Preservation Officer, and the Office of Archeology and Historic Preservation (National Park Service, Department of the Interior). While the term "archeology" was the most widely used term when referring to the project's cultural resources, other cultural resources are present and have been studied.

Between May, 1974, and September, 1976 more than $200,000 was spent on the study, publication, coordination and planning regarding the project's cultural resources. No area of comparable size in northern California had previously been examined so intensely. The study included historic, ethnohistoric, ethnographic and archeological research.

The issue of seismicity and its possible effects upon the safety of the dam arose during the initial District Court proceedings concerning the adequacy of the final EIS. The District Court, however, did not find the EIS to be inadequate in the manner in which seismicity was discussed. The decision to perform a dynamic analysis was voluntarily undertaken by San Francisco District in order to alleviate the public concerns of an admittedly sensitive subject. When the tests were completed, the Corps, again voluntarily, agreed to make design modifications in the interest of public concern, as indicated from the analysis, even though the Corps and its Board of Consultants felt these modifications were overly conservative.


Architectural rendering of Warm Springs Creek Bridge.

The expanded water quality monitoring program which began

in July, 1974, has produced data from new sampling stations and has provided additional information on the distribution of mercury, arsenic and asbestos. Samples were taken from water, sediments, soil, fish, insects and algae. Research was also conducted on geological formations as they relate to ground water. In general, the latest, more detailed, information supports the conclusions drawn from the earlier data that the water of the proposed reservoir will be of high quality and sufficient to satisfy proposed uses. All things concerned, it would surpass EPA standards for drinking water.

Litigation has had a terrific impact upon the economics of the project. In late 1964, it was estimated that the improvement would cost about $42 million. Five years later that figure had more than doubled to $90 million. Five years more — in 1975 — the estimated cost for Warm Springs had risen to $160 million, and by 1979, to $232 million.

Local interests will provide lands required for the downstream channel improvement works at an estimated cost of $85,000 and will maintain the channel improvements after completion. Under provisions of the 1958 Water Supply Act, the Sonoma County Water Agency contracted for perpetual rights to 132,000 acre-feet of storage capacity for water supply. This was the first contract of its kind to be negotiated with the Corps of Engineers in California. Moreover, local interests must reimburse the Federal Government for cost allocated to water supply storage, which has been estimated to be some $63.9 million.

Besides the cultural, recreational, and water supply aspects associated with the project, the flood control properties of the improvement will afford protection to more than 20,000 acres of land downstream, and to the people that live and work on that land. These are used for agriculture and recreation, and include 15 resort communities and numerous summer and permanent homes. If the project had been completed and in operation during the December 1964 flood, it would have prevented damage estimated at $3.6 million.

Over the years the flood control program of the Corps of Engineers in California has prevented more than $4.5 billion in flood damages throughout the state. The San Francisco District, which stretches over a significant part of California, has made a significant contribution to the total savings. But we are reminded that floods do more than simply cause damage to homes, businesses and farms. They also kill people, disrupt families and bring suffering in many other tangible and intangible ways.

Unfortunately, many streams remain unchecked, and with the crush of population moving into, and relocating within San Francisco District, it can reasonably be predicted that in selected areas, families will still have to leave their homes in the wake of flood waters. Fortunately, the District continues to study the streams and river basins of the Pacific Coast, with a view toward prudent management practices.

Studies

The Flood Control Act of 1962 authorized the District to study all streams in Northern California flowing into the Pacific Ocean. A number of separately authorized "sub-studies", if you will, are to be completed within the framework of the study, which is scheduled for completion in 1982.

The Guadalupe River, which drains an area of 800 square miles in Santa Clara and Alameda Counties and flows into lower San Francisco Bay, is also under investigation. Inadequate and decreasing channel capacities, and subsidence of the valley floor in recent years have contributed to flooding, bank erosion and (in the lower reaches of the river) total inundation from the bay.

This study is oriented toward flood control improvements for that portion of the Guadalupe River included in the Department of Housing and Urban Development Model Cities Program for San Jose. Improvements along Silver Creek will also be studied. A target date late in 1980 has been set for completion of this investigation.

Another study in progress within the Bay Area is that being done in relation to flood and related problems along Novato Creek and its tributaries in Marin County. Its purpose is to examine the feasibility of building levees and realigning or otherwise improving stream channels to protect urbanized areas. Completion of this study is expected momentarily.

Within the Central Coastal Basins, San Francisco District is completing investigations on the Carmel, Pajaro, San Lorenzo and Salinas Rivers. Due to their proximity to rich agriculural lands, as well as to the ocean, with its favorable climate which attracts people by the hundreds of thousands, floods have in the past, and in all likelihood will in the future, cause significant damage. Studies here will include consideration of reservoir storage projects, levee construction and channel improvements, flood plain management measures, and various combinations of these approaches to flood damage prevention. Work on most of these investigations should be completed by the early 1980s.

Down the years, beginning in 1927, the Corps of Engineers in general, and the San Francisco District specifically, have worked tirelessly in the public's interest to lighten the burden of floods. In 1936 and again in 1944 their mission was enlarged and clarified. But Congress, responding to the magnitude and continued rise of the nation's annual flood losses has continued to enact legislation providing new tools to cope with flood risk. These new laws have taken the forms of water supply acts, environmental protection regulations and water quality enactments, in addition to annual flood control acts.

The traditional strategy of modifying floods through the construction of dams, channel alterations, high flow diversions and spillways, and land treatment measures has repeatedly demonstrated

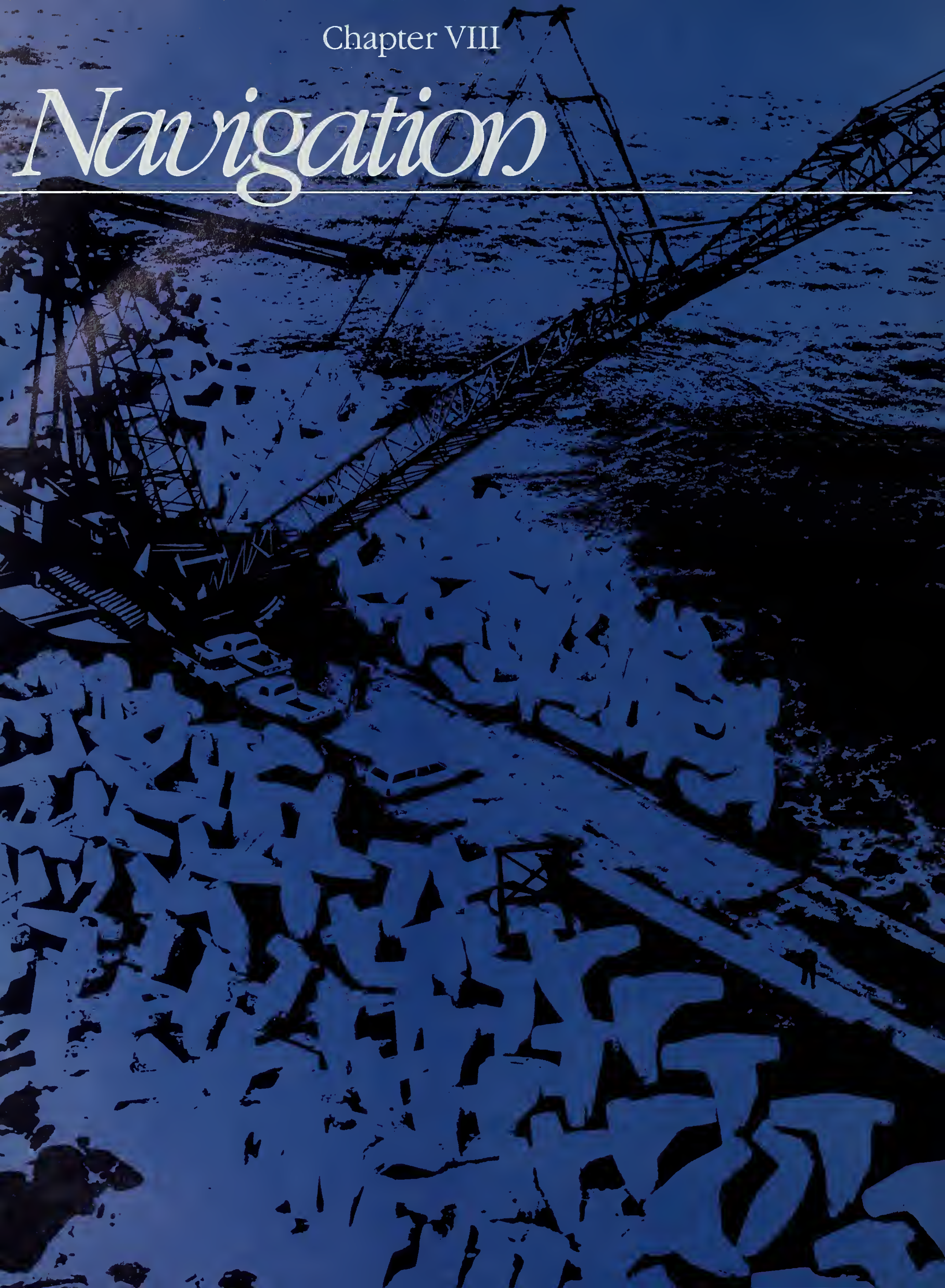
its effectiveness for protecting property and saving lives, and will continue to be a method of flood plain management. However, in the future, reliance solely upon flood modification strategy is neither possible nor desirable. While the large capital investment required by flood modifying tools has been provided in large measure by the Federal Government, sufficient funds from Federal sources have not and are not likely to be available to meet all situations for which flood modifying measures would be both effective and economically feasible. Yet another consideration is that the costs of maintaining and operating flood control structures fall upon local governments, except for major federal reservoirs with flood control storage.

Flood modifications acting alone leave a residual flood loss potential, and at the same time can encourage an unwarranted sense of security leading to inappropriate use of lands in the areas that are directly protected and others in adjacent areas. Hence, in the future, measures to modify possible floods will usually be accompanied by measures to modify the susceptibility to flood damage and especially by land use regulations. The San Francisco District has, and will continue to shoulder, a large portion of the responsibility to ensure that the above takes place.

Carmel River – flooding the Carmel River Inn – 1967.

Chapter VIII

Navigation



During the thirty-year period from 1950 to 1980, San Francisco District maintained all of the harbors and navigation channels it had created to mid-century. In addition, the District constructed entirely new harbors at Half Moon Bay and Santa Cruz, did major rehabilitation work at Crescent City, Humboldt Bay, and Bodega Bay, expanded improvements at Oakland, Richmond, and San Francisco, and built a pair of breakwaters to protect small craft harbors — one at Berkeley and another at Gas House Cove, at the east end of the San Francisco Marina. At the same time, the District undertook several navigation studies, particularly within and around San Francisco Bay Area harbors in relation to dredging and disposal methods of dredged materials.

The scientific data base for the majority of the work accomplished in the Bay Area, especially in terms of environmental quality was derived from studies conducted using the San Francisco Bay and Delta Model located in Sausalito, California. The development of the Model was in turn, the outgrowth of the need to test major elements of what was known as the "Reber Plan."

Reber Plan and Bay Model

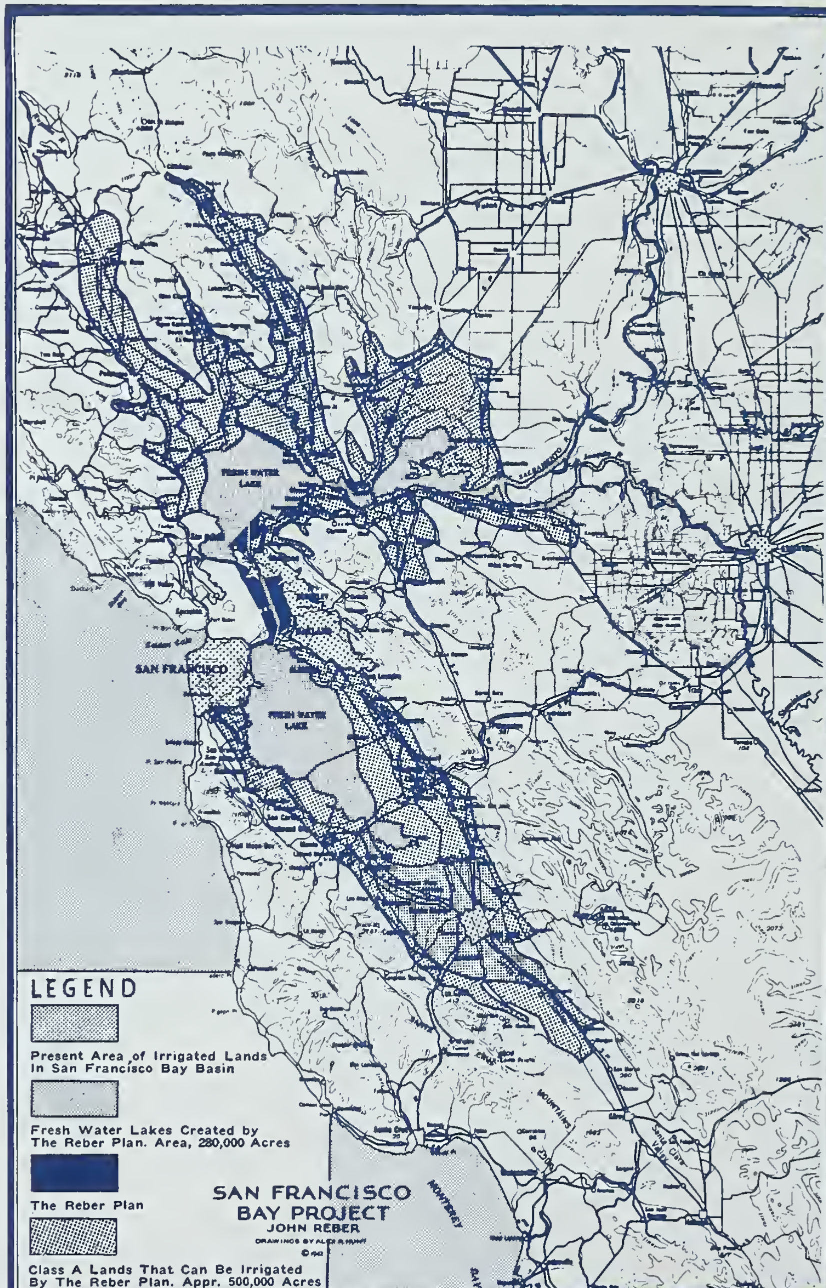
Named for John Reber, who developed it, the plan envisioned a pair of low, rock and earth-fill barriers, one to the north of San Francisco to be constructed from San Rafael to Richmond and another, to the south of the City, connecting Candlestick Point to Alameda County. The latter would be wide enough to carry both rail and highway traffic. Once in place, the barriers would create two fresh water lakes covering some 80,000 acres. These new lakes could then supply irrigation water for the farm lands in the surrounding counties. Between the lakes, Reber's plan proposed the reclamation of some 20,000 acres of land that would be crossed by a deep, fresh water channel a dozen miles in length. On the west-bay side of the channel would be airports, a naval base and a pair of locks, equal in size to those of the Panama Canal to provide access to the lakes for military and commercial shipping. The east-bay side of the channel was to be developed primarily for industrial plants. In addition to all of this, Reber proposed underground hangars and storage depots for military needs. Finally, the plan called for submarine and torpedo boat bases to be integrated into the overall scheme of things.

For several years military planners had been studying the idea of an additional bay crossing to satisfy future defense needs. As early as 1941 a joint Army-Navy Board investigated and reported on the need

Opposite page: Placing dolosse at Humboldt jetty.

and feasibility of constructing a bridge between Hunters Point, in San Francisco County, to Bay Farm Island, in Alameda County. Though the investigation received a negative recommendation, another Army-Navy Board was convened in 1946 to review the finding of the 1941 Board, and to study the system of dams across San Francisco Bay as proposed by the Reber Plan. While the Board recommended a new transbay crossing, they rejected the Reber Plan on the grounds that, if implemented, industry would be dislocated; economically the idea was not feasible, and from the viewpoint of navigation and military considerations it would be untenable. Interestingly enough, impact upon the bay's environment was not a major issue.

Proponents of Reber's concept persisted, a result of which



Senator Sheridan Downey and members of the Senate Committee on Public Works opened, on December 8, 1949, a six-day public hearing in San Francisco relative to Senate Resolution 119, 81st Congress, 1st Session. That resolution, to investigate the needs of the San Francisco Bay Area, had been adopted on May 23rd. During the public hearing, more than a hundred civic leaders and experts in a variety of fields appeared to lend support to the Reber Plan. The following May (1950), Congress passed Public Law 516, 81st Congress, 2nd Session, and Section 110 of the River and Harbor Act, based upon Senate Resolution 119, which authorized the Corps of Engineers to conduct a preliminary examination and survey relative to the comprehensive development of the San Francisco Bay and its tributaries. The study was considered to be one of the most all-inclusive civil works projects authorized for implementation by the Corps to that time.

Though delayed because of the Korean War, the San Francisco District submitted the preliminary examination report on June 29, 1953. For the most part the report was favorable, in that it recommended a more detailed survey be undertaken — one that should include the construction of a hydraulic model capable of duplicating the functions of San Francisco Bay. Moreover, the District wanted the model located in the Bay Area so that it would be close at hand.

This last recommendation generated a considerable amount of discussion and correspondence. For, up to that time the vast majority of studies requiring the utilization of models were conducted at the Waterways Experiment Station located at Vicksburg, Mississippi. Many Corps personnel didn't feel the need to build a completely new facility somewhere else. To resolve the question the Board of Engineers for Rivers and Harbors agreed to hold their January, 1954, hearing in San Francisco. This was precedent setting action in that this was the first time such a meeting was held in the Bay Area.

The Board found in favor of the San Francisco location, and funds for construction were subsequently authorized in 1954. The existing warehouse located at the District's base yard in Sausalito wherein the model was to be housed was altered in 1955, with actual construction of the Bay Model getting under way in March 1956. That portion of the model extending east to Antioch, at the head of Suisun Bay, was completed in 1957. After completion, a two-year period of verification was done, followed by over three years of work on the comprehensive study. On July 30, 1963, data contained in the comprehensive study was released during a public meeting held at the model.

Over the years concentrated studies were conducted upon the barrier portions (the essential elements) of the Reber Plan, as well as seven other proposals. When the study was completed, the Reber barriers failed to survive critical examination.

In presenting the study to the public, Brigadier General Arthur Frye Jr., South Pacific Division Engineer, told those in attendance that the Corps now had an unequalled and unparalleled instrument for future planning that would be of extreme value to all agencies engaged

in influencing the development of the Bay. The General particularly emphasized the fact that the Corps had discovered that when planning water resources development for San Francisco Bay, such planning could not be detached from Statewide considerations.

During the ensuing years the model became a focal point of public usefulness and study. Tourists, school children, university students and residents of the region continually visited the project. Moreover, it was in constant use by federal, state and private agencies in the gathering of technical data about the Bay.

During the first years of its existence, studies were made of solid fill barriers, the dispersion and flushing of pollutants, the effects of reclaiming tidal and marsh lands, sedimentation, shoaling, harbor and channel dredging, and related phenomena.

Once the District had completed the initial comprehensive study, it was suggested that the model be closed down. Public opinion was such that, not only was it not disbanded, but Congress authorized expansion of the model to allow study of the Sacramento and San Joaquin Rivers and the vast Delta of those rivers. The expanded model was completed in 1969.

Using actual salinity measurements, the model illustrates the effect of such proposed man-made changes in the Bay-Delta as the peripheral canal to transport water south around the Delta and the San Luis drain for agricultural waste water. Dispersion of wastes from municipal and industrial plants is demonstrated during dye tests.

Deposits of mud and silt in Bay shipping channels continually interfere with vessel traffic. An average of 8,000,000 cubic yards of material are dredged annually at a cost of millions of dollars. From measurements in the Bay, analysis of dredging practices, and model experiments, specific information is obtained on the complex factors producing shoaling.

The renovated Bay Model Visitor Center was officially opened in September 1980.

Since the model must perform the same as the actual Bay, but to proper scale, careful measurements are made of the natural occurrences taking place. A network of tide stations, for example, has been established around the shores of the Bay and Delta to record automatically on a chart, the rise and fall of the water surface.

The hydraulic model of the San Francisco Bay and Delta was built to a horizontal scale of 1 foot = 1,000 feet, and a vertical scale of 1 foot = 100 feet. The limits extend from Alviso to Napa and from the Pacific Ocean to the areas of Sacramento, Stockton and Tracy.

Although the model does not look exactly like the real Bay, its action is similar in reproducing to proper scale the rise and fall of the tide, flow and currents of the water, mixing of fresh and salt water, and in indicating trends in the disposition of sediments. The engineers are able conveniently to examine forces in the Bay, and from model experiments, analyze what would happen should man-made changes be made in the Bay itself.

In the future, major emphasis will be on environmental quality, as affected by fill, pollution, and fresh water flows; the dispersion of pollutants from all drainage areas, including the Central Valley; and methods to alleviate problems of salt water intrusion into the Delta.

Bay Area Harbors

The San Francisco Harbor Project extends from the Pacific Ocean offshore approach channel, through San Francisco Bay, to the San Francisco Airport, located south of the City.* Throughout the 1950 s, the hopper dredges Hyde, Mackenzie, Biddle, Rossell, Davison and Harding, were kept busy throughout the Bay, maintaining project depths; and in the case of San Francisco Harbor, dredging the channel through the bar to the authorized depth of 50 feet, and working to deepen various approaches and turning basins. By 1959, the bar channel had finally been dredged to 50 feet, and most all of the other work on the San Francisco Harbor project completed.

Then in 1965, the massive and controversial San Francisco Bay to Stockton (John F. Baldwin and Stockton Ship Channels) Project was authorized by the River and Harbor Act of that year. This new law authorized improvement of navigation channels extending from the San Francisco Bay entrance to the port of Stockton through San Francisco, Marin, Contra Costa, Solano, Sacramento and San Joaquin Counties. The project, consisting of improving navigation channels, constructing various new navigation facilities and constructing associated recreational facilities, provides for the modification of five completed navigation projects. These consist of:

1. Modification of the San Francisco Harbor Project by dredging the main ship channel through the bar from 50 to 55 feet.
2. Modification of the existing Richmond Harbor Project by deepening the West Richmond Channel through the west navigation opening of the Richmond-San Rafael Bridge from 35 feet to 45 feet, and by enlarging and deepening the present approach area to Richmond Long Wharf to provide a maneuvering area 45 feet deep, 600 to 2,800 feet wide and 8,400 feet long.
3. Modification of the existing San Pablo Bay and Mare Island Strait Project by deepening and lengthening Pinole Shoal Channel to 45 feet and about 11 miles long, and by dredging a 45-foot maneuvering area adjacent to Oleum Pier.
4. Modification of the present Suisun Bay Channel Project by deepening and widening the existing project depths and widths to those presently being studied by both San Francisco and Sacramento Districts. There is also some thought being given to the possiblity of providing new facilities such as maneuvering areas and turning basins in the existing project reach of Suisun Bay.
5. Modification of the Stockton Deep Water Ship Channel by deepening it from 30 to 35 feet, realigning the channel to follow the False River route, adding a new turning basin and

*For additional information regarding the status of San Francisco Bay during the mid-1960s, see Appendix H.

maneuvering area, constructing public recreation facilities, and placing rock revetment on levees bordering the channel. This last project area is under the jurisdiction of the Sacramento District.

The total first cost of the project is estimated at $139 million of which $108 million would be the Federal cost of new work. San Francisco District began dredging the main channel across San Francisco Bar in the summer of 1971, and completed the work (to 55 feet) during February of 1974. Sacramento District initiated bank protection work between Venice Island and Stockton in December, 1971, and completed this phase of the work during the summer of 1972.

Due to the significant question raised by a host of Bay Area environmental groups, the passage of the National Environmental Policy Act, and the Corps' perceived need for a complete reassessment of the environmental impact of the project, further construction has been deferred.

During the last 30 years, Oakland Harbor has grown to be one of the major ports in the western hemisphere. By 1979 the east bay port was recognized as the largest container port on the West Coast. Tonnage handled by Oakland in 1978 totaled 10,126,150 tons, an increase of 10 percent over 1977. Container tonnage, which represented 80 percent of the cargo handled by the port, amounted to over 8,000,000 tons.

During the 1950s, the San Francisco District maintained authorized channel depths within the inner and outer harbors at Oakland. Then in 1962 the project received authorization to deepen the 30-foot inner harbor channel to 35 feet and to deepen the lower

The 85,000-ton tanker Phillips Louisiana *unloads at Martinez refinery on April 30, 1973. Tankers of this size transfer part of their cargo to barges before using 35 foot channels to shore-side piers. Corps of Engineers-proposed 45 foot Baldwin Channel would allow tankers to go to piers without additional danger of oil spills during transfers.*

1,300 feet of the north channel in Brooklyn Basin from 25 to 35 feet. These improvements were completed by the District in 1975. In the meantime a 1972 Congressional resolution authorized a study of the Oakland Outer Harbor. The resolution requested recommendations for the most effective, efficient and economic means of developing the outer harbor to serve deep draft shipping needs with identification of the depth and extent of dredging required, and the extent of Federal interest. The subsequent study was combined with investigations of Redwood City and Richmond Harbor under a special in-depth study of the San Francisco Bay Area. An interim report, however, favorable to deepening and widening the outer channels of Oakland Harbor was completed in 1977 and is now in process to Congress.

Acres of storage area has allowed Oakland Harbor to handle unprecedented amounts of cargo.

Oakland Outer Habor.

Panoramic view – Richmond Harbor.

Improvements of Oakland Harbor by the San Francisco District Corps of Engineers has contributed significantly to the growth of the harbor and its use for commercial shipping, military purposes and recreational boating.

By selective placement of spoil materials from the harbor dredging operations, several thousand acres of submerged land or swamp have been reclaimed for industrial, commercial and military uses.

Commercial cargo handled at Oakland Harbor is extremely varied, but major classes of cargo in 1977 were made up of food and food products, petroleum projects, and iron and steel products. Other important cargo consisted of wood products, and sand and gravel, and crushed rock.

Just as Oakland Harbor had grown during the last quarter-century and more, so had Richmond Harbor, Oakland's neighbor to the east-north east. The last modification to Richmond Harbor was authorized by the River and Harbor Act of September 3, 1954. New work approved was a channel 35 feet deep and 600 feet wide adjacent

to Southampton Shoal; enlarging and deepening the approach area to Richmond long wharf; widening and deepening the inner harbor and entrance channels; deepening the turning basin at Point Richmond and southerly 2,000 feet of Santa Fe Channel. Worthy of note was the elimination of the previous restriction that widening the channel north of Point Potrero not be undertaken until local interests furnished assurances that industries will avail themselves of the improved navigation facilities.

On the other hand the 1954 act required that local interests furnish, without cost, all necessary easements for the improvements and suitable spoil-disposal areas for the new work and subsequent maintenance. In addition they had to construct and maintain suitable wharves, shiploading facilities, and cargo-storage and handling facilities adjacent to the deepened portion of Santa Fe Channel, with the provision that such wharves and facilities, intended for public use, be open to all on equal terms.

Richmond Long Wharf – one of the busiest oil ports in the world.

Assurances guaranteeing fulfillment of these requirements were furnished by Resoltuion No. 6062 adopted by the city of Richmond, August 8, 1955, and accepted by the District Engineer, Colonel John A. Graf, on September 29, 1955. San Francisco completed the enlarged project at Richmond in 1957, except for the dredging of the West Richmond Channel and the enlarging and deepening of the maneuvering area off the Richmond Long Wharf, both of which are currently unscheduled. Federal cost for the completed work was about $3 million, while local interest cost amounted to $4 million. The estimated cost of the authorized but unscheduled improvements is about $15 million.

Richmond is the site of extensive commercial petroleum refining and handling facilities, as well as a Department of the Navy fueling depot. The harbor serves these petroleum and fueling facilities as well as general commercial shipping. As of 1980 the harbor complex, in general, comprises approach, entrance, and inner harbor channels, turning basins, a maneuvering area, and a training wall.

During 1977, the waterborne commerce through Richmond Harbor totaled some 23,800,000 tons, 90 percent of which was petroleum and petroleum products. The remaining 10 percent was comprised mainly of food products, chemicals, and iron and steel scrap.

During the past decade, commerce in Richmond Harbor has just about doubled. Due to current demand and to planned development in bulk, general cargo, and containerized shipments, the principal harbor channel is viewed as inadequate. Deepening a turning basin at the inner harbor to 40-50 feet, and providing a 40-50 foot controlling depth throughout the harbor development south and east of Richmond Long Wharf are presently being studied by San Francisco District as part of the San Francisco Bay Area In-depth Study. A report on this phase of the investigation is expected to be completed momentarily.

The only major harbor to the south of San Francisco is Redwood City Harbor. In 1950 San Francisco District received authorization to extend the 30-foot deep channel some 1,300 feet upstream and to provide a second turning basin in the harbor. This work was completed in 1965. That same year an investigation of the entire project was authorized by Congress to study any increased harbor usage and resulting environmental effects that would result from deepening the present channel to 37 feet in order to allow fully loaded modern cargo vessels to enter the harbor at all tidal stages. This study is part of the in-depth investigation being conducted all about the Bay.

San Francisco District completed a small but important navigation project on Islais Creek, which is located at the south end of the Port of San Francisco. During the 1960s and 1970s commerce on this small tidal stream increased to the point where the navigation channel proved inadequate for the demands placed upon it. Following the development of a detailed project report, and the review of same, San Francisco District deepened the channel by dredging, from 35 to 40 feet in 1977. Annual commerce carried on this modest channel is about 1,000,000 tons, or just about the same handled each year at Redwood City Harbor.

Dredge Chester Harding tied up at Sausalito.

A pair of small navigation projects, primarily in the interest of recreational boating, were also completed in recent years by the District. The first of these was the Berkeley Harbor Project, authorized by the Chief of Engineers on January 15, 1965, under authority of section 107, 1960 River and Harbor Act. Between June and October, 1965, San Francisco District (by hired labor) placed 55,107 tons of stone to create a detached rubblemound breakwater 725 feet long, bayward of the existing harbor entrance. The completed federal work cost $155,550, in addition to $155,551 contributed by local interests.

A similar harbor project was completed by the District near the east end of San Francisco Marina, and is known as Gas House Cove (East Harbor Facility, San Francisco Marina). Over the years, wind, waves, and surge had created very hazardous conditions for pleasure craft moored in the harbor area. San Francisco District alleviated this

dangerous situation, when in 1975, it completed a 117-foot concrete sheet pile breakwater connecting two existing breakwaters. Federal cost amounted to $180,000 and local interests contributed $154,000.

In addition to the above navigation and harbor projects, large and small, San Francisco District has been very active during the past 30 years in maintaining, primarily by dredging, several other important navigation channels throughout the Bay. The largest of these are the San Pablo Bay and Mare Island Strait Channel, and the Suisun Bay Channel. Each year millions of tons of cargo are moved over these vital waterways, and thus they must receive regular attention by the District to ensure that adequate depths are maintained. Over the years hopper dredges have removed tens of millions of cubic yards of shoaled materials from these areas. Moreover, engineering, design, survey and shoaling projects have been conducted to monitor the condition of the channels from year to year.

Three other small navigation projects, completed by the District prior to mid-century have been maintained in the interest of commercial and recreational boating. These are Napa River, Petaluma River and San Rafael Creek. While a modest amount of commercial traffic utilizes these channels, they have, in recent years, become especially popular as centers for recreational boating.

The unsung heroes of all of this channel work, both within the bay, and in the District's other coastal harbors, are the hopper dredges, and the intrepid crews who man them. Typical of these dredges is the hopper dredge *Harding,* constructed in 1939, by Pusey and Jones Corporation, Wilmington, at a cost of $1.7 million. Current replacement cost for the *Harding* would be in excess of 12 million dollars.

For several months each year her crew of 12 officers and 53 men works on a 12-day operation, 2-day tie up schedule. The hopper dredge works on a principle similar to a vacuum cleaner. The dredge has pipes called dragarms extending from each side of the hull. Drags at the end of each dragarm are lowered to the bottom of the channel, and then slowly pulled over the area to be dredged. Pumps create suction in the dragarm and the silt or sand is drawn up through the arms and deposited in bins in the mid-section of the dredge. When the bins are full, the dredge proceeds to a place of disposal where the load is either directly pumped ashore or material is dumped through bottom doors in deep water. When disposing loads by pumping out, the dredge pumps draw the material out of the hopper bins and force it through a pipeline into a disposal area on shore. Dredging is sometimes performed by sidecasting the material, which is discharged through a sidecasting boom outside the channel limits on certain projects where littoral currents carry the dredged material from the channel area. When a channel has been dredged to the prescribed depth, a Corps of Engineers survey boat checks the work by making soundings in the area.

The *Harding* has an overall length of 308 feet, 2 inches, and overall beam, including drags, of 73 feet, and a molded depth of 95

feet. The draft when empty is 15 feet, which allows for a vertical clearance of 95 feet. When loaded, with a displacement of 7,523 tons the draft is 21 feet. This allows seven feet of freeboard.

The *Harding* was repowered in 1958. Four-cycle diesel engines manufactured by Enterprise furnish the power for the pumps and for propulsion. Auxiliary power is supplied by two 600-horse-power Superior Diesels each operating a 300 KW DC generator. Under normal conditions only one DC generator is used and the other is held as an emergency standby.

The two 8-cylinder Enterprise diesel propulsion engines each develop 2120 horsepower at 375 RPM. Each engine drives, through a 2:1 reduction gear a 4-blade, controllable pitch propeller having a diameter of 10 feet, 6 inches. With a diesel fuel bunker capacity of 1600 barrels, the ship has a cruising radius of 2200 miles.

The two 6-cylinder Enterprise diesel pump engines each develop 1,000 horsepower at 252 RPM. Both the pump engines and the propulsion engines have the same 16-inch bore and 20 inch stroke; therefore, many parts on the four engines are interchangeable. The pump engines are connected to the pumps by direct drive. Each pump has a 22-inch suction and a 20-inch discharge. A maximum dredging depth of 62 feet can be reached with the 22-inch dragpipe. A self-adjusting type California draghead weighing some five tons is used on each dragpipe.

The pumps on the *Harding* each have a distribution system in the hoppers (eight hopper bins provide for a hopper capacity of 2680 cubic yards). This allows each dragtender to monitor closely what his pump is producing. The two pumps deliver an average of 208 cubic yards of material and water slurry per minute which results in an average retention rate of 60 yards per minute.

Besides prosecuting civil works activities, the hopper dredges have, over the years, been engaged in military work. Probably the most famous was the *Mackenzie,* captained by Carl Heil of San Francisco. Built in 1920, the *Mackenzie* removed mud and silt from harbors and channels all the way from Wrangel Narrow Alaska, to San Diego. In the Bay Area her operations included Treasure Island, Mare Island Strait, Oakland Harbor, Richmond Harbor, Pinole Shoal, channels approaching Alameda Naval Air Station and Oakland Supply Depot and the San Francisco Bar.

The *Mackenzie*, with Captain Heil at the helm, went to war in 1943, where she dredged channels under combat conditions at Midway, Saipan, Tinian, Guam and Okinawa. In large measure she paved the way for our capital ships by converting these islands into major bases for operations against Japan.

After dredging her way through the war unscathed, she was struck by a near-disaster while anchored in Buckner Bay at Okinawa. The typhoon of October 9, 1945, which swept the China Sea, caused tremendous damage to American military shipping. During the storm, a Navy L.S.T. went out of control and snapped the *Mackenzie's* anchor chain, casting her adrift in the fearful confusion of damaged and sinking ships. She was driven onto a partly submerged reef, which

ripped a hole in her forward engine room, and she was battered for the duration of the storm by the high running sea and uncontrolled ships.

The dredge spent 12 days on the reef, before she could be pulled off and emergency repairs made. The *Mackenzie* was then towed back to the Bethlehem Steel Corporation in San Francisco. On June 20, 1949, the dredge was put back into operation in San Francisco Bay. During the next year, still under the command of Captain Heil, the 268-foot ship picked up and dumped more than 7,000,000 cubic yards of sediment from the bay — an average of one load every hour.

Today, the disposal of dredged materials is a major problem in the waters of the San Francisco Bay complex. The San Francisco District, in conjunction with the State Water Quality Control Board (San Francisco Bay Region) and the Environmental Protection Agency developed criteria for disposal of dredged materials, and it is expected that present disposal methods will be revised or that all hopper dredges will be required to have pumpout capabilities for land fill disposal. Either of these would increase dredging costs. Moreover, the option for land fill disposal is rapidly diminishing and long distance disposal would significantly increase federal and local interest costs for dredging. The disposal problem is accentuated because local interests usually furnish lands, easements, and rights-of-way for construction and subsequent maintenance of projects.

Presently San Francisco District is authorized to utilize three in-bay disposal sites for dredged materials: S.F. #9 located at the mouth of the Carquinez Strait; S.F. #10 located within San Pablo Bay opposite Pinole Point; and S.F. #11 situated south of Alcatraz Island.* Each of these is a high energy area, which means that the tidal currents disperse the material quite rapidly.

In addition to the in-bay disposal sites, San Francisco District is authorized to use two ocean areas. One — S.F. #8 is located a nautical mile south of the bar channel and is used exclusively for the deposition of material dredged from the San Francisco (Golden Gate) Bar. The other site, S.F. #7 is known as the Hundred Fathom site and is located southwest of the Farallon Islands.

It is estimated that approximately eleven million cubic yards of natural sedimentation flow into San Francisco Bay annually. While significant amounts pass through the Bay and are dispersed into the Pacific Ocean, still larger quantities settle within the bay itself. Until recently the San Francisco District had almost the exclusive responsibility (and ability) for removal of much of this accumulated sand and mud — at least that portion that clogs ship channels and harbor facilities. Presently, however, private dredging companies and their advocates in Washington, D.C. are working to convince Congress that the Army Engineers should turn over dredging activities to non-government firms.

*EPA designations.

Public Law 95-269, passed but a few years ago, states that if private companies can do the dredging work in a timely and economical manner, they should be given the opportunity to do so. Under the Industry Capability Program (ICP), bids are invited from private firms and, when received, compared with estimated costs put forth by the Corps for the same work — that is, the amount of time and money required for an Army hopper dredge manned with Corps personnel to complete the task. If the private bid does not exceed the government estimate by more than 25%, the contract will be awarded to the private company.

During FY 1979 the project to dredge Humboldt Bar and the entrance channel to Humboldt Bay was put out to bid, but there was no response from private industry. In FY 1980 there was one bidder for the San Francisco Project and a total of three for the Mare Island Strait and Humboldt Bar work. In all cases, however, private industry bids exceeded the Corps "estimate plus 25%" formula. Nonetheless, there seems to be a trend developing to extract the responsibility for dredging from the Corps of Engineers and to place it in the hands of private interests.

Study of these emerging conditions will examine effective, efficient, and economic means of maintaining authorized navigation channels. Environmental and ecological factors, completion of authorized projects, future navigation requirements, and technological developments will all be carefully studied and given proper consideration.

North Coast Harbors

San Francisco District's northernmost harbor is located at Crescent City. During the storms of 1948 and 1949 major portions of the breakwater protecting the harbor were severely damaged. To repair the structure, and to make it more effective, the crest was raised to 20 feet above mean lower low water (MLLW), with a concrete cap 22 feet wide along the entire breakwater length to prevent overtopping.

During the winter of 1950-51 the outer portion of the breakwater again suffered considerable damage because of the pounding sea waves.

In view of the high cost of maintaining the breakwater and the unsatisfactory wave-action conditions in the harbor, the Chief of Engineers directed that a field conference be held in Crescent City to discuss means for strengthening the breakwater and improving wave conditions in the harbor. A letter report submitted by Colonel K. M. Moore, San Francisco District Engineer, to the Chief of Engineers, presented a geneal summary of the field conference held early in June, 1951. A Definite Project Plan for strengthening the breakwater was presented in the report entitled "Brief Definite Project Report on Work Remaining at Crescent City Harbor, California." This report outlined

the improvements considered necessary to afford the harbor proper protection from wave action and was in general agreement with the conclusions and recommendations arrived at during the June field conference. The report recommended:

1. The existing breakwater be strengthened with additional stone placed on the seaside slope.
2. The authorized breakwater extension be redirected in an easterly direction for a distance of 1,000 feet.

Previous experience with breakwater damage at Crescent City indicated that the proposed strengthening would involve difficult design and construction problems. The stability of rubble breakwaters of sufficient height to prevent overtopping is a function, primarily, of wave height, seaside slope of the rubble mound, and the weight, specific weight, and shape of the individual cap stone used as a protective layer for the core material. When waves overtop a rubble breakwater, the width of crown, weight of cap rock exposed to the overtopping waves, and harborside slope also influence the stability of the structure.

According to the "Brief Definite Project Report" prepared by San Francisco District, the most severe storm at Crescent City for the period 1930-1950 resulted in waves estimated to be 26 feet high in deep water. It was also estimated that waves 20 feet high lasted some 34 hours during a particular storm. If that were not enough, results of a refraction-diagram analysis indicated that waves with a maximum height of 33 feet could occur at the breakwater site. Additional factors pertinent to the problem of designing a modified breakwater at Crescent City which would be stable under the attack of storm waves were also listed in the District's report:

1. The maximum weight of stone that could be quarried economically in the area was about 12 tons.
2. The use of floating plant for breakwater construction at Crescent City was not practical; therefore, all stone had to be placed by equipment operating from the breakwater crown.
3. The equipment then available was capable of placing stone a maximum distance of 120 feet from the center line of the breakwater.
4. The water depth at the breakwater site (at the outer limits) averaged about 35 feet at high tide.

While conducting research at the Waterways Experiment Station (WES) at Vicksburg, the Corps of Engineers discovered that the weight of cap stone required to protect the breakwater and, hence, the harbor would have to be in the neighborhood of 35 to 60 tons. This was considerably more than the 12 ton maximum size stone available on the North Coast.

The South Pacific Division Engineer, Colonel Donald Burn, had been aware of similar problems faced by the French in protecting their harbors in the Mediterranean. As early as 1946 the French firm of Neyrpic (later absorbed by Sogreah) was commissioned to study designs for more effective facing to be used on the seaward side of a large breakwater at Oran, Algeria. Eventually, after a great deal of

research, the French developed what was called a "tetrapod," from "tetra," meaning four and "pod," meaning foot. In combined form the words refer to a four-footed geometric form used in breakwater construction. It may be visualized as four cones meeting at the same angle and equi-distant from each other around a sphere.

Knowing of the new design and of the difficulties involved with trying to construct a lasting breakwater at Crescent City, the South Pacific Division Engineer initiated investigation of their use. WES was assigned this duty by the Chief of Engineers and conducted experiments during the period August 1953 to December 1953. The tests indicated that the use of tetrapods to stabilize the damaged portions of the Crescent City breakwater was feasible and that two layers were sufficient to provide adequate protection to the existing rubble mound.

Based on the results of the WES tests, the San Francisco District evolved a tetrapod design which was put into final form at a conference held on December 12-14, 1955. The meeting was attended by representatives from the Office, Chief of Engineers, the WES, the South Pacific Division, and the San Francisco District. A Mr. Marcel N. Marty, one of the tetrapod engineers from France, came to San Francisco after a stopover at the WES and made an inspection of the Crescent City Project.

With very slight modifications based on further Vicksburg tests, the final design was approved at the conference. To meet both the French and WES criteria, it was decided to use two layers of 25-ton tetrapods. The final design for Crescent City called for use of the tetrapods on a 560 foot extension. The specifications also provided for a cap extension of 550 feet and 100 foot radius circular end section composed entirely of tetrapods. The total number of blocks required was 1630.

On June 14, 1956, the first tetrapod was cast at Crescent City by Peter Kiewit Sons' Company under a $1,300,000 contract. The work was supervised by Gordon W. Stark, Resident Engineer of the North Coast Regional Office of the San Francisco District.

The 25-ton geometric blocks stood 10.5 feet high when resting on three legs. The distance between end faces of any two adjacent legs was roughly 12.6 feet. The tetrapods were cast using no reinforcing of any kind and depended solely upon the concrete for their strength and mass.

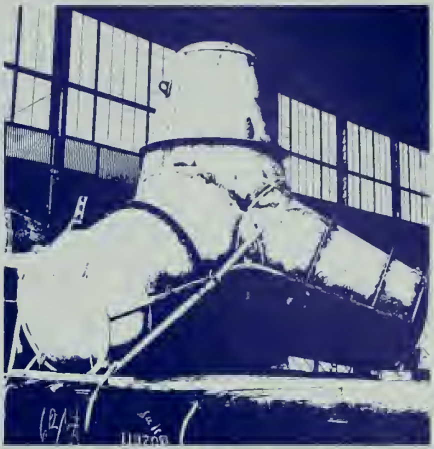
Engineering history was made during the latter part of 1956 and early 1957 with the placing of the tetrapods on the Crescent City Breakwater. For this was the first time they had been used in the Western Hemisphere. In addition, several tons of stone were also placed on the breakwater prior to its completion in October 1957. The San Francisco District's experience at Crescent City led to the use of tetrapods at Kahului Harbor breakwater on Maui, Hawaii, at Santa Cruz Harbor (in a slightly modified form), and at other coastal installations around the nation.

The year 1964 was a particularly bad one for the residents of Crescent City. Late in March of that year a devastating tsunami (great

sea wave generated by an earthquake) spawned by an earthquake in Alaska on March 28, 1964, struck Crescent City and its harbor. The tsunami was of such magnitude that a wall of water rushed inland from the sea, gathered the ebbing water in the shallow draft harbor before it, and completely submerged the central portion of Crescent City. Eleven people lost their lives, and 29 city blocks were heavily damaged. The giant wave destroyed public, private and commercial property that amounted to $11 million.

Following the tsunami, San Francisco District personnel arrived in Crescent City to begin emergency operations. The O.E.P. relied upon the Corps to furnish estimates of damages to public property including clean-up of streets, roads and highways, restoration of storm sewers, and repair of Citizen's Dock.

Local Congressmen called upon the District to survey Crescent City and Crecent City Harbor, which were declared a joint disaster area on April 3rd. A Corps of Engineers project office was immediately established to begin contracting for debris cleanup, which began on April 6th. More than 35 contracts were let with a value in excess of $250,000. The emergency work performed under the direction of San Francisco District was completed in early July.



Tetrapods were cast in giant form – Crescent City 1956.

Tetrapods await placement at Crescent City – 1956.

Hardly had the residents dug out from the debris and destruction of the tsunami than the record storm of December 1964 fell upon them. On this occasion the breakwater was again battered and damaged, and the harbor rendered useless because of the logs, lumber, remains of homes and other debris that completely choked it.

In light of the above, major rehabilitation and expansion of the breakwater was authorized in 1965. In addition, the dredging of a "T" shaped basin within the harbor to a depth of 20 feet was also approved. All of this was in addition to the rehabilitation of the outer breakwater begun in March and completed in October 1964.

The new work on the inner breakwater authorized in 1965 was finally completed in 1973, but work on the inner harbor basin has been

Tetrapod being placed on Crescent City Breakwater – 1956.

Broken tetrapods show the effects of damage suffered during 1964 Christmas storms.

Tetrapod being hauled to placement site on breakwater – Crescent City 1956.

deferred indefinitely. The last major rehabilitation work was performed in 1974 when dolosse armor units were used in place of tetrapods (dolosse will be discussed in detail when reviewing Humboldt Bay).

Over the years Crescent City Harbor has grown considerably. Waterborne commerce in the harbor was about 290,000 tons in 1977 and averaged about 284,000 tons annually for the period 1968-1977. Except for 9,000 tons of fish, cargo consisted entirely of petroleum products in 1977. The growth experienced at Crescent City can be attributed to a significant degree to the efforts of the San Francisco District and the excellent work done by the Engineers to improve the region's principal harbor.

Cars and mobile homes were tossed about like toys by the tsunami that struck Crescent City in 1964.

The San Francisco District scored another first in the area of harbor protection in the early 1970s when dolosse were placed on the Humboldt jetties. In fact, the story of the rehabilitation of the Humboldt Bay jetties is one that is unique in the United States, as well as in the worldwide construction industry. For one thing, this was the first time this artificial armor shape had been used in the nation. Secondly, these were the largest dolosse ever cast, to that time, in the world. Lastly, the concrete was required to be of unusually higher than normal density.

For almost a generation, the seas that pound the area showed that traditional repairs offered no long-term security — the sea was not going to be beaten by a stonewall defense. During the winter of 1957-58, severe storms caused the deterioration of the north and south jetties. The trunk portions of the jetties were repaired using mass concrete and 12-ton stones during the period 1960 to 1963. The heads of the jetties were reinforced by using 20-ton blocks for perimeter forming and placing mass concrete within block forms reinforced with large reinforcing bars and track rail. But then again during the winter storms of 1964-65, the 100-ton blocks were washed away, leaving the jetties vulnerable to the raging seas. By 1970 the heads of the jetties

The tsunami completely destroyed this Crescent City wharf.

Typical Crescent City scene prior to clean-up by the Corps of Engineers.

Dolosse ready to be placed on Crescent City breakwater.

were totally destroyed and another major rehabilitation work began with a new approach in yet another attempt to thwart the attack of the violent sea.

Beginning in the late 1960s, WES at Vicksburg began an intensive study in an effort to discover the best way to protect the Humboldt Bay jetties. First, a model of the north jetty was constructed. Then a variety of different concrete shapes were tested in varying configurations, slopes and sizes. This went on for nearly two years. One of the significant problems for WES was to decide the slope on which a placeable shape could or should be used. The type of equipment to be used for placing was still another major concern. For design purposes, the Manitowoc 4600 Ringer crane was considered the only feasible device.

One of the ideas to emerge from the study was to link the shapes in the form of a necklace to improve stability. As a matter of fact, the initial set of plans for bidding included this requirement. The idea was abandoned, however, because none of the bidders could figure out how they were going to string 42-ton beads on a 1 1/2-inch stainless steel cable. At the time, the Corps as well didn't know how it might be accomplished but thought that an innovative contractor might come up with the right plan.

After the testing and re-testing of various alternative designs, the Corps decided upon the dolos (dolosse being plural), invented in South Africa, but never before used in the United States and never with the idea that they would be produced in such a huge size or in such quantity.

Dolosse armor units were placed on top of the rock and tetrapods placed earlier.

Each dolos measures 15 x 15 x 15 feet and contains over 19 yards of concrete, weighing either 42-tons or 43-tons depending upon the mix formula used and the specific gravity of the aggregate. The advantage of the dolos configuration is that the interlocking shapes present no surface large enough for a giant wave to strike with all its force but allow its dissolution in a maze of shapes.

A major controversy arose during the design and bidding stage, primarily within the Corps itself, around the question of reinforcing steel. The initial design, submitted by San Francisco District, followed the inventor's lead and had no reinforcing. Corps officials, however, thought it advisable, owing to the unprecedented size, that reinforcing be added. The final design called for reinforcing the huge concrete shapes.

To prepare plans and specifications for this project and also to verify the model findings, a topographic survey had to be made of both jetties. For areas above mean sea level, or even mean low water, aerial photogrammetric methods could be used. On the other hand, it would have proved dangerous in the extreme to attempt a hydrographic survey for the underwater portion of the work by boat; yet, this was the most important area to survey, since 75 to 80 percent of the work was below mean sea level.

To do this all-important work, an Army helicopter was flown out from Fort Sill, Oklahoma, and fitted by the District's survey crew as a sounding platform. Using this and a transit crew on a safe location on the jetty, the District was able to sound around the monolith heads from the air.

In preparing the plans and specifications, the Corps had to be sure that a contractor could actually perform the work successfully within each short construction season. A pre-bid conference was held by the District to discuss concerns the potential contractors might have and to clarify any points they wished to air in front of their competition. Questions raised had to do with sequence of the restoration work, sources for heavy aggregates needed for the dense concrete, and the methods to be used to link the 42-ton dolosse. After the contractors were told that the requirement to link the giant shapes was to be omitted, they asked the Engineer to define the term "pell mell," which described the method of placing dolosse. This term, from the South African inventor, seemed to cause some confusion. One bidder jokingly asked if the District meant what Webster's said, that is, something done in great haste. Another contractor said he found an old English definition as being "higgedly piggedly" and wanted to know if that is what the District meant. Eventually, the language of the contract read "random placement." Finally, the linking problem was eliminated by changing the 42-ton units to 43-ton units in the area where the linking was to be done.

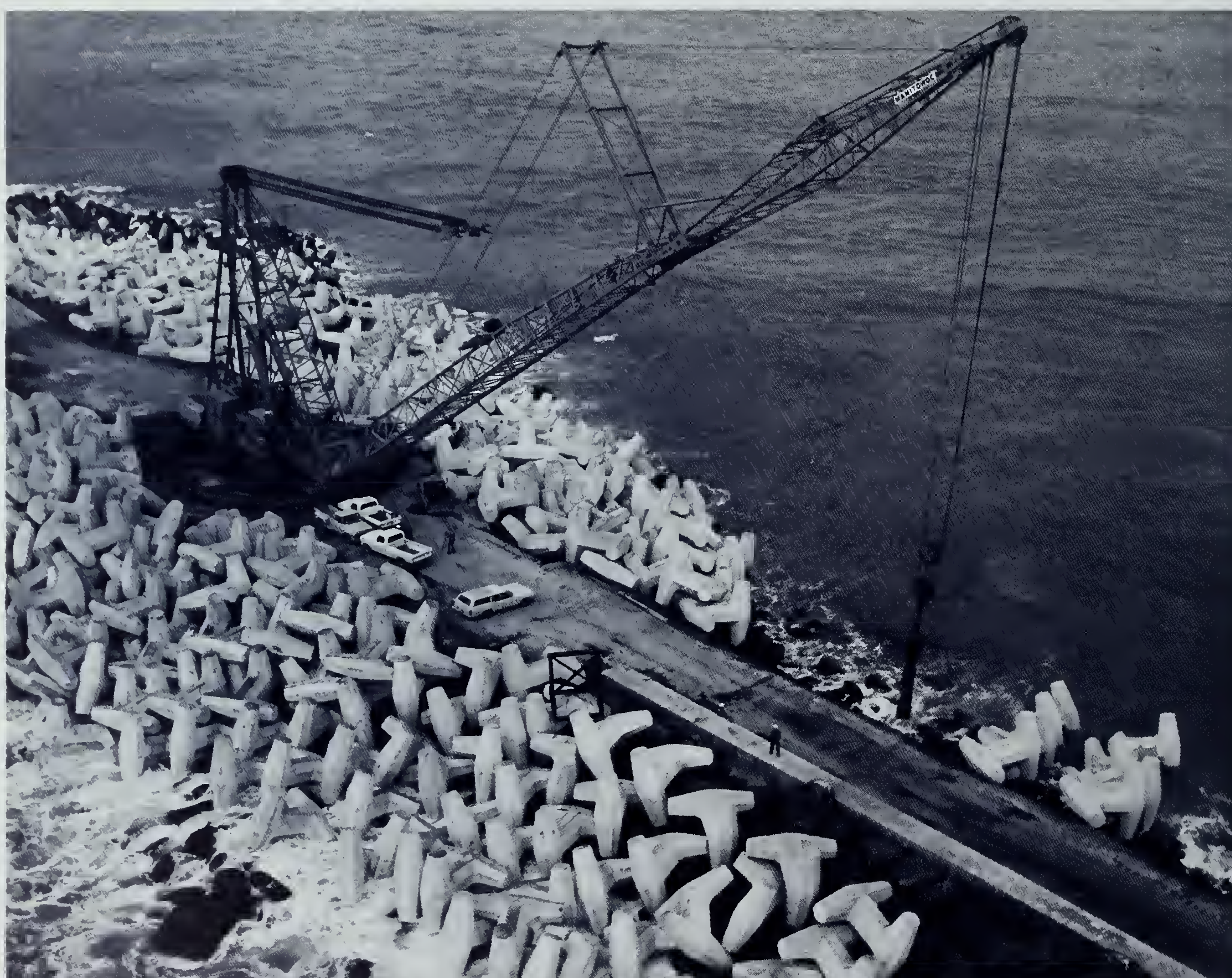
When the bids were opened, there was considerable variation in them. The lowest, of $9,185,000, in fact was below the government estimate by a considerable amount. To avoid the possibility that a mistake had been made, the low bidder was asked to verify his bid. After he assured the District that it was correct and that he was satisfied

with it, the contract was awarded, and he was given notice to proceed.

During the period of mobilization, which was quite lengthy in this case, disagreements arose between the contractor and the District. For one, the contractor felt the concrete mix stipulated by the Corps was unworkable. Another area of disagreement came up when the contractor proposed the elimination of all steel reinforcing from the dolosse.

Even so, by early summer, 1971, the contractor had completed mobilization of his ringer crane on the jetty head and was ready to start placing dolosse. The contractor and the District field personnel had jointly prepared a placing diagram with the center, or pick, location of each dolos shown on a scaled plan as a dot. Each of the two layers and the toe units were so marked and resembled concentric circles from the center of the ringer, whose location was determined in advance. The quantity of dolosse was specified as 11 per 1,000 square feet of area. The District also specified that each serially-numbered dolos have its exact location recorded, which was another reason for the elaborate placing plans.

Dolosse being placed on south jetty – Humboldt Harbor.



The project was completed with the last dolos being set in place in 1973. A remarkable fact about the project was that during the hundred thousand man hours of labor and exposure to the elements in this most hazardous area there was not a single lost time accident. And in spite of the fact that there was occasional friction between contractor and District, the Corps felt that the contractor had performed in an outstanding fashion. So, upon the recommendation of the District, the contractor was given a special citation signed by the Chief of Engineers. The plaque was presented in San Francisco in June 1973.

During this same period hopper dredges continued to maintain safe depths over the bar and throughout the authorized channels within Humboldt Bay. But it was the jetties—their design, re-design, construction, repair, rehabilitation and reconstruction that has been particularly noteworthy. This was true to such a degree that in October 1977 the American Society of Civil Engineers designated the jetties an historic civil engineering landmark in recognition of the outstanding pioneering achievement made by the San Francisco District in its quest to improve the quality of life of the residents of the Humboldt Bay region.

Two other harbors situated between San Francisco Bay and Humboldt Bay were also maintained and repaired during the period 1950 and 1980. These are Noyo River and Bodega Bay Harbors. During the mid-1950s San Francisco District placed tons of stone and several hundred cubic yards of cement on the jetties of Noyo River Harbor to repair and strengthen them. Similar work was completed during the early 1960s. In 1968 the Noyo Harbor District, with funds provided by a grant from the Economic Development Administration, constructed a mooring basin and a 400-feet channel extension. Over the years, the mooring basin has been maintained by local interests, while the San Francisco District has maintained the jetties and harbor channel.

Presently, Noyo Harbor supports a sport and commercial fishing industry which is vital to the economy of the community of Noyo. Two hundred fishing boats are permanently berthed at Noyo and about 500 use the harbor during the salmon trolling season. In 1977 the commercial fish catch was about 7,800 tons.

Eighty-five miles south of Noyo Harbor is the triangular-shaped lagoon known as Bodega Bay. San Francisco District completed major rehabilitation of the harbor channels and the south jetty during the summer of 1961. In doing so almost a hundred thousand yards of shoaled material was dredged to complete restoration of the project channels. Then, under a continuing contract, 17,134 tons of stone were placed on the south jetty.

On November 6, 1964, the Chief of Engineers recommended modification of the existing Bodega Bay Project to provide a rock and riprap-protected earth mole 4,500 feet long westerly of the existing channel along the eastern shore and to dredge a channel 10 feet deep and 100 feet wide on the north side of Doran Beach spit. Though authorized, construction of the 4,500-foot earth mole has not yet

Humboldt jetties protect the entrance to the Bay.

begun. Moreover, during advanced engineering and design studies, Spud Point was found to be a more desirable location for expansion of the harbor facilities. Pending provisions for meeting requirements of local cooperation for the new work, the project is being held in abeyance.

To date, Bodega Harbor remains the only improved harbor in the 140-mile reach between San Francisco Bay and Noyo Harbor. Besides serving as an important harbor of refuge, it is also the home of a modest commercial fishing fleet. Commerce in the harbor in 1977 amounted to about 1,900 tons of fish.

Harbors South of San Francisco Bay

Half Moon Bay Harbor is located about 15 miles south of San Francisco. The project was authorized by the River and Harbor Act of June 30, 1948, and consists of two breakwaters that form a protected harbor for commercial fishing vessels and recreational craft. Before San Francisco District could begin construction of this small but important facility, local interests were required to establish a competent and properly constituted public body empowered to administer the harbor facility and to furnish assurances satisfactory to the Secretary of the Army that they would:

1. Make available to the United States the right to obtain, free of royalty costs, the necessary stone for the initial construction and future maintenance of the breakwaters from a source acceptable to the District Engineer, when and as required.
2. Provide without cost to the United States all necessary lands, easements, and rights of way for the construction of the project.
3. Provide and maintain without cost to the United States necessary utilities and mooring facilities, including a public landing with suitable supply facilities open to all on equal and reasonable terms.
4. Contribute $100,000 toward the first cost of the improvement.

By the summer of 1961 the local interests had established the San Mateo County Harbor District, which had complied with all items of local cooperation except construction of the port facilities. They had, however, developed plans for the required construction and had in fact by that time opened bids for a public wharf and related facilities.

During the 1950s the San Francisco District had completed extensive surveys and designs for the harbor. The District then began construction, finishing the west break-water in September 1960 and the east breakwater in June 1961.

Following the District's work at Half Moon Bay, it was discovered that wind, wave and surge action was having an adverse effect upon the boats moored in the Harbor. To provide an adequate solution to the problem, WES at Vicksburg conducted model studies of the situation and recommended, as a remedial measure, the construction of a 1,050-foot extension of the west breakwater. This new work to alleviate the surge problem was completed in 1967. Since that time the San Francisco District has repaired the breakwater as necessary and maintained a minimum depth of 6 feet over the 245-acre harbor area. Total cost of the project to date has been $6,700,000. The cost of meeting requirements for local cooperation

was about a million dollars.

The waterborne commerce of Half Moon Bay Harbor, which amounted to about 570 tons in 1977, consists entirely of fresh fish and shellfish. The town of Princeton at the northern end of the bay has become the center of a commercial fishing and fish processing industry. Finally, the project constructed by the San Francisco District has materially expanded harbor usage by commercial and pleasure craft and has stimulated industrial and recreational activities in the tributary area. And like its counterparts, north and south, Half Moon Bay Harbor provides a needed port of refuge for small craft during storm periods.

The newest harbor built by San Francisco District is that constructed in Woods Lagoon near the eastern part of the City of Santa Cruz. A harbor at Woods Lagoon was initially the subject of an Army

Half Moon Bay breakwater.

Engineers' study in 1915. In 1918 a letter from Secretary of War Newton Baker to the Speaker of the House of Representatives outlined the report from the Chief of Army Engineers on the Woods Lagoon study. In his letter, Baker asked that a harbor project for the lagoon be considered by Congress.

During the following decade local citizens made various attempts to get a harbor built there. But with the Wall Street Crash of 1929 and the Great Depression, no one seemed to have the time to devote to the push for a harbor.

The project lay dormant until the end of World War II. In 1947, a hearing was held in Santa Cruz during which local interests again asked the Corps of Engineers to build a harbor. In mid-1949, the Engineers gave preliminary approval, which got the project underway.

In October 1949 Colonel F.E. Tandy, San Francisco District

Half Moon Bay Harbor.

Engineer, told local harbor enthusiasts that a port district was the necessary first step in creating a harbor. During June 1950, a petition signed by 3,000 Santa Cruz residents was submitted to the County Supervisors asking for construction of the harbor and creation of the port district.

In the election of November, the district returned a 2,271 to 1,644 vote favoring the harbor. The newly formed district included the city of Santa Cruz, the San Lorenzo Valley up to Big Trees, and the area between Santa Cruz and Porter Gulch, excluding the community of Capitola.

Unfortunately the Korean War caused the project to be shelved for a few years. The River and Harbor Act of 1958 authorized construction of the harbor, but it wasn't until 1961 that Federal funds were finally appropriated for the work. By that time the Santa Cruz Port District had furnished assurances of their willingness and ability to comply with requirements of local cooperation, and the San Francisco District had completed advanced engineering and design work for the project. Construction of the jetties was begun in April 1962 and completed in May of 1963. The necessary channel dredging was finished by the District in November 1963.

Utilizing knowledge gained at Crescent City a few years earlier, San Francisco District built the Santa Cruz jetties with quadrapods — geometric concrete blocks very much like the tetrapods. The first of the 28-ton quadrapods was cast on July 27, 1962, and the last one on February 5, 1963. A total of 899 (one rejected and one broken in handling) were cast in 114 working days. Hauling and placing started on November 2, 1962 and were completed on March 5, 1963. Daily placement ranged from a minimum of 14 to a maximum of 69, with an overall average of 41 per day.

Following construction of the harbor jetties in 1963, the District maintained the project through annual dredging operations. Then, in a study completed in the early 1970s coordinated with WES and the Santa Cruz Harbor District, it was recommended that a jet pump be installed in Santa Cruz Harbor for sand bypassing operations. The system was installed in June 1976 and operated by personnel from WES for several months to determine the ability of the system to remove sand from the harbor during periods of severe shoaling. Eventually this floating system was found unacceptable, and provisions were made for a fixed sand bypassing system.

Facilities at Santa Cruz include a municipal pier with berthing and marine supply and repair services. Local interests were responsible for construction of the pier. The harbor, which is maintained by the Corps, has slips for 900 recreation boats. Commerce in Santa Cruz Harbor amounted to 200 tons of fish in 1977.

In addition to the harbor at Santa Cruz, the District has, over the past 30 years, maintained the harbors at Monterey and Moss Landing. For awhile it looked as though a much needed addition to the breakwater at Monterey was going to be built. Such an addition was authorized in 1960 but is presently inactive due to lack of local support. In 1977 commerce at Monterey Harbor totaled about 10,600

tons of fish and nonmetallic minerals.

The economy of Moss Landing is presently sustained by commercial fishing and by offshore handling of petroleum products by pipeline and barge. Commerce in Moss Landing Harbor consisted of 2,200,000 tons of petroleum products and 10,000 tons of fresh fish in 1977.

Studies

Studies similar in nature to the San Francisco Bay Area In-depth Study are currently being conducted at harbors along the District's coastline. A special investigation of the Humboldt Bay region was begun in 1976. Although physically smaller than San Francisco Bay, Humboldt Bay has similar environmental characteristics. The purpose of this study is to determine optimum economic, environmental, and social uses of the bay and its environs. The investigation will include, but not be limited to, examining present land use patterns, determining the extent of various government jurisdictions and their impact on land use, examining the suitability of land and water resources for single and multiple pupose uses, and developing other data needed to provide the basis for sound and integrated planning at local, regional, state and Federal levels. At the present time, no firm completion date has been set for this study.

Under the title "Harbors for Light Draft Vessels—Coast of California," investigation of a chain of harbors for refuge and other purposes along the California coast was authorized by the 1945 and 1946 River and Harbor Acts.

In the northern coastal reaches of California, conditions hazardous to small boats can rapidly develop due to dense fog, ground swells from distant storms, or from sudden intense local storms. Along the southern reaches, there are only a few harbors of refuge within safe sailing distances of one another. The lack of harbors of refuge is of particular significance to the fishing industry, which is vital to the economy of numerous coastal communities. Moreover, the popularity of recreational boating along the coast increases each year. The full economic potential of either or both of these cannot be realized, however, unless adequate harbor facilities are available.

At the present time, study emphasis is being placed upon Moss Landing Harbor. This harbor is close to the fishing banks as well as being situated in an area considered to be the major seaside recreational center of the central coast region. The existing harbor, completed in 1947, is now overcrowded and judged inadequate for present needs. Enlargement of the existing federal portion of the lagoon is under consideration.

Another proposed small-craft harbor on the San Mateo County coast in the vicinity of Pacifica will also be investigated.

While a systems analysis that treats the entire northern coastal reach as a unit was completed in 1971, completion of the entire study is indefinite. Interim reports for the Moss Landing and Pacifica studies are expected momentarily.

In sum then, improvements for deep and shallow draft navigation carried out by San Francisco District fall into the category of coastal harbors. This can subsequently be divided into channels and anchorages for deep draft and shallow draft shipping, harbors of refuge for small craft, and breakwaters and jetties to provide protection against wind and waves. Shallow draft navigation includes commercial fishing, recreational boating, and barge traffic. By integrating these projects with railroads and highways, the waterways improved by San Francisco District are helping to meet the ever increasing transportation needs of coastal California, the nation and the world.

Moss Landing Harbor 1975

Chapter IX

Environment

When Congress passed the River and Harbor Act of 1899 based on the Interstate Commerce Clause of the Constitution, the San Francisco District was given the authority to control work in navigable waters. And since the Act did not define the term "navigable" it was rather natural that the District limited its regulatory authority to areas which were obviously navigable. The establishment of harbor lines for the preservation and protection of harbors and the establishment of public dumping grounds were examples and a typical reflection of the interpretation of "navigable" waters. In the Bay Area especially, the lack of other federal, state or local regulations as well as the public ignorance of areas adjacent to "navigable" waters was particularly devastating.

In 1850 the bays, including San Pablo and Suisun Bays, comprised almost 448,000 acres. By 1958, filling and diking had reduced this area to 278,000 acres. In other words, over a period of a little more than a century, the Bay areas had been reduced by 38 percent. This loss was primarily marshlands surrounding the bays.

As insignificant as the loss seemed in years past, we know today, and research has shown, that the Bay Area lost 38 percent of its "kidneys and lungs." Left without a great deal of its cleansing ability, the capacity to transmit vital oxygen into the waters, the Bay, and the life it spawned and supported in its salt-marshlands, was dying.

The District's hand was strengthened in 1948 by the passage of the Water Pollution Control Act. Responding to this Act, and the growing pollution problem evidenced in the Bay Area, South Pacific Division published a booklet in 1949 entitled *Oil and Refuse Pollution–Navigable Waters of the United States–California.* In the document, the Corps outlined the extent of the Engineers' jurisdiction, specific ways to avoid polluting the waters of the area, and the penalties for violation.

The problem of pollution in San Francisco Bay became critical by the late 1950s. In fact by 1959, the Navy's seaplane operations were curtailed to the point where the night training flights operating from the Alameda Naval Air Station were transferred to the cleaner water of San Diego. Ironically, part of the problem was caused by the ban on open burning by the Bay Area Air Pollution Control District. According to statements made by Colonel John Harnett in February, 1959, the rising hazard to seaplanes and small craft was largely due to the fact that dumps, which were prevented from burning refuse because of air pollution controls, left debris on the shores of the bay. High tides, especially in winter months, swept the material into the Bay.

Harnett suggested that other causes of the debris problem were rotting pier structures and material brought down the rivers and creeks that emptied into the Bay. While pointing out the causes, he urged all residents and business people to take every reasonable action to prevent foreign substances from entering the Bay. Finally, he

Opposite page: Debris collection crews retrieve a variety of materials from the Bay – including the remains of the Clearwater.

warned dump owners and other potential polluters that dumping trash into the bay was prohibited by federal law. He left no doubt that violators would be prosecuted. By the end of the year San Francisco District brought charges against dump operators for violating the law.

Throughout the 1960s and early 1970s, a variety of National and State laws were passed in an effort to clean up the environment. Of particular note were the 1972 amendments to the Federal Water Pollution Control Act, in that they strengthened further the regulatory function of the Corps of Engineers (Section 404).

As the nation became more and more aware of its dwindling environmental assets, the San Francisco District willingly assumed a leadership role relative to environmental protection of San Francisco Bay. It is worth noting that by this time (1970) probably less than 256,000 acres were left of the Bay.

Even before the 1972 amendments became law. District Engineer Colonel Charles Roberts informed the public (June 11, 1971) that he was going to exercise his jurisdiction to the plane of mean higher high water (MHHW) line. Then on January 18, 1972, he stated that he would exercise jurisdiction over unfilled areas behind dikes. According to newspaper accounts of that time, his actions didn't go unnoticed. Articles in both the *San Francisco Examiner* and the *Chronicle* told how the Corps of Engineers was on the move and had entered the environmental era with an eagerness and readiness that probably exceeded that of any other governmental agency.

The expanded role of the San Francisco District was almost overwhelming, given the fact that the District had over 1,300 miles

Dumps around the San Francisco area contribute to floating debris in the Bay.

of ocean and river shoreline and more than 77,000 acres of wetlands.

Colonel Roberts' successor, Colonel James Lammie, upon assuming responsibility for the District in 1972, notified all public agencies, hundreds of private individuals and scores of commercial firms of his determination to clean up the Bay Area in terms of the 1972 amendments. Like Roberts, his predecessor, Lammie also promised to take prompt action in cases of violation.

When the enforcement personnel were increased from 2 1/2 (a secretary was shared) to five inspectors, routine inspections by helicopter were stepped up and violators were prosecuted, it became apparent that San Francisco District meant what it said.

On May 10, 1973, proposed changes in the regulations relative to permit activities were published nationwide. The final regulations became effective on April 4, 1974. As it stands today, the Corps' permit program covers just about everything built in, on or into waterways. In addition, filling, discharges, pipes and cables, tunnels, boat ramps, dredging, buoys and dumping are regulated by the permit program. Thus if a company or individual wants to locate a structure in, excavate, or discharge dredged or fill materials into waters of the United States, or if they plan to transport dredged material for the purpose of dumping it into the ocean waters, a Corps of Engineers permit is required.

Just prior to the adoption of final regulations in the spring of 1974, San Francisco District assumed regulatory authority over portions of the Sacramento District. Approximately 210 miles of shoreline and some 54,000 acres of wetlands were added, bringing the

This dump yard along Oakland Estuary shows how easily debris can enter Bay waters.

District's total shoreline to about 1,500 miles and 131,360 acres of wetlands.

Colonel Henry Flertzheim took over the helm of San Francisco District in September 1974. Without hesitation he chose to stay on the excellent course set by his predecessors. With increasing frequency he confronted the pressures from powerful groups who seemed rather dissatisfied with the District's new image, role and power in the field of environmental concerns. To deal effectively with the expanded responsibilities, Flertzheim enlarged the regulatory and legal staff so that in 1975 the Enforcement Section had seven inspectors and the Office of Counsel a pair of full-time environmental attorneys. By that time the staff was handling half a dozen litigation cases and preparing several more.

Closely allied to the Corps' permit program are regulations contained in the National Environment Policy Act of 1969. In the main, the act encourages productive and enjoyable harmony between man and his environment, promotes efforts to prevent damage to the environment, stimulates the health and welfare of man, and deepens the understanding of ecological systems and natural resources. Under section 102 of the NEPA, every recommendation for projects to be constructed by the San Francisco District with federal funds must include a detailed statement on:

1. The environmental impact of the proposed action.
2. Adverse environmental effects that cannot be avoided should the proposal be implemented.
3. Alternatives to the proposed action.
4. The relationship between local, short-term use of the environment and the maintenance and enhancement of long-term productivity.
5. Any irreversible and irretrievable commitments of resources that would be involved in the proposed action should it be implemented.
6. The coordination of the proposal with interested federal, state and local agencies.

In a joint memorandum dated August 18, 1975, issued from the Office, Chief of Engineers, it was pointed out that the environmental guidelines for the implementation of the Section 404 permit program for the discharge of dredged or fill material were the result of hard work by both the Environmental Protection Agency and the Corps. Moreover, Chief of Engineers, Lieutenant General William C. Gribble, Jr., in the same memorandum stated that full implementation of the Section 404 program offered an excellent opportunity for rational environmental decisions on the discharge of material into the aquatic environment. District Engineers were reminded that should the Corps fail in the reasonable administration of this program the Engineers would not only lose credibility in the implementation of the 404 program, but might suffer in other aspects of their regulatory programs as well.

Debris collection crews retrieve a variety of materials from the Bay – including the remains of the Clearwater.

Debris crewman plucks an oil-soaked gull from the Bay.

Yet another project of enormous proportions involving San Francisco District is the EPA Grants program. In January 1978, EPA and the Corps of Engineers concluded an interagency agreement providing for 600 man-years of assistance from the Corps annually for three years in projects across the nation. The Corps' specific function is to utilize its expertise in the area of construction management to oversee the building of sewage treatment facilities and to provide periodic on-site inspection for other projects.

On October 1, 1979, San Francisco District received responsibility to oversee the construction management of two major wastewater projects being built in the Bay Area. The City and County of San Francisco Wastewater Program, with an estimated cost of over $2 billion, is the larger of the pair and, in fact, is the largest clean water project in the entire nationwide program. It is scheduled for completion in eight to ten years. The construction project includes treatment plants, sewer interceptors and force mains, pump stations, and in-line storage basins.

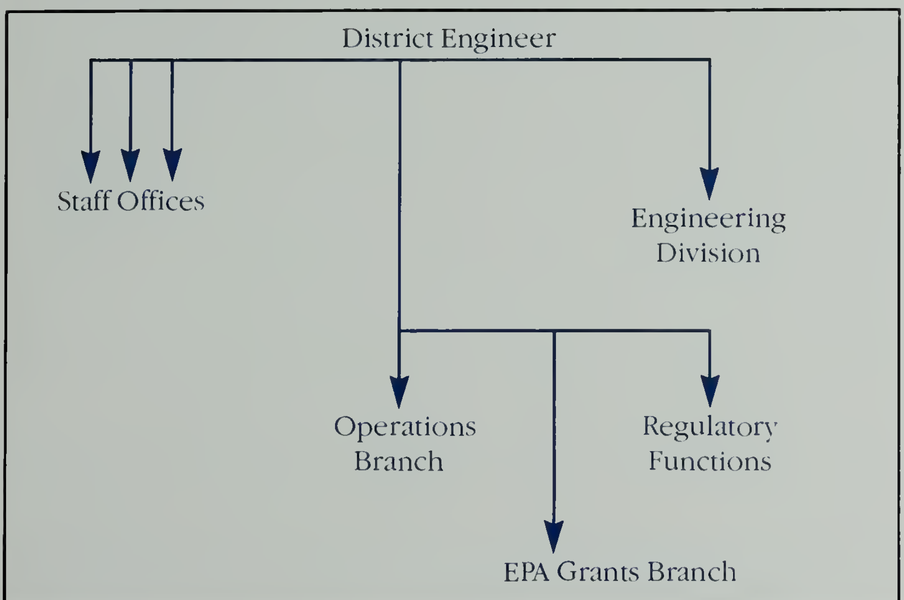
When operational, the new facilities will treat and divert sewage on the Bay side of the San Francisco peninsula and then transport it by means of tunnels across the southern part of the city to eventually be disposed into the ocean just south of the Fleishhacker Zoo.

The smaller of the two projects is the East Bay Dischargers Authority. This project will cost approximately $150 million and will

Floating debris is not only harmful to the marine environment, but is a very real danger to shipping.

extend from San Leandro south to Union City and Fremont. When completed in 1982, the new system will transport treated sewage from along the East Bay communities into a "super sewer" for eventual disposal into the middle of San Francisco Bay.

The chart below illustrates how the EPA Grants Branch fits into the overall scheme of the District's operation.



The Raccoon *and the* Coyote *in search of debris.*

The branch is under the overall supervision of Walter Boyle and is staffed by a secretary and one each of the following: civil construction engineer, structures and soils engineer, environmental engineer and mechanical engineer. In addition, the Intergovernmental Personnel Act allows federal agencies to exchange personnel between and among local, state and federal governments for training and development purposes. Under this authorization, four State of California employees work in the EPA Grants Branch.

Closely allied to the above is the work being accomplished by the District's Regulatory Functions Branch. It has been suggested that if *water resources development* represents the right hand of the Corps, then *water resources management* — as exemplified by programs of the Regulatory Functions Branch — must be the left hand. The primary function of the branch is to regulate and monitor developments of all kinds in the water courses of the San Francisco District.

It will be recalled that all Corps of Engineers construction projects must satisfy the requirements of all applicable laws and those public interest requisites prior to authorization by Congress. To insure that all other types of construction within or upon the District's waterways — that is, non-Corps of Engineers projects — meet similar rigid specifications, various plans, applications and reports must be filed with and approved by the Corps of Engineers. It is the Regulatory Functions Branch that handles this work. Typical structures that fall within the purview of this branch are piers, docks, marinas, repair yards, and launching facilities. Besides structural kinds of projects monitored, the branch also reviews and makes judgments about dredging, fill and related kinds of activities proposed by private industry firms.

Presently there are 23 staff positions in the Regulatory Functions Branch. This number reflects the continued growth of the commitment by the Corps to protect the public interest relative to projects that have potentially negative impact upon the natural aquatic environment.

During the last few years, under the able leadership of Colonel John Adsit, San Francisco District has continually been on the cutting edge of efforts to correct past environmentally related mistakes and to set a prudent course for reasonable use of our limited resources in the future. Two programs unique to the San Francisco District will serve to illustrate these efforts.

Begun by his predecessors, Colonel Adsit has continued to hold meetings that have become known as "environmental teas." These gatherings are part of an effort to maintain contact with groups and individuals of the Bay Area who are interested in the environment and its preservation. During these informal meetings the District Engineer and the District's staff personnel present current information on many of the District's major projects and studies to representatives of local environmental groups. During a recent "tea" Colonel Adsit welcomed the guests and then provided time for staff from the Regulatory Functions Branch and the Environmental Branch to share information about the environmental aspects of the Corps projects and permit

actions. This particular meeting (December 1978) was highlighted by guest speaker Dan Chapin, chairman of the California Waterfowl Association, who spoke on the "Impacts of Corps Programs on Bay Area Waterfowl Habitat." Following the speech, Colonel Adsit fielded questions from environmental groups and then invited those who were interested to take a tour aboard the hopper dredge *Biddle*.

Environmental groups represented at the "tea" included the Bay Conservation and Development Commission, U.S. Fish and Wildlife Service, Friends of the Earth, Save San Francisco Bay Association, Sierra Club, People for Open Space, Audubon Society, West Contra Costa Conservation League, Oceanic Society, and the Marin Conservation League. Each person, or group, was encouraged to ask penetrating questions of the District, so that any and all misinformation and rumors could be supplanted with firsthand, up-to-date knowledge. But more than that, these meetings provide yet an additional forum for concerned citizens to express their knowledge and deeply held convictions about the how, why and what of Corps programs for Bay development, management and preservation.

Another unique activity initiated and maintained by San Francisco District is the educational program taught by San Francisco Community College Instructor Ida Geary — renowned Bay Area author, naturalist and teacher.* The classes, dealing with the flora and fauna of Bay Area wetlands, were initiated by Hans Lamm and Frank Butler of the Regulatory Functions Branch after new regulations became effective in the summer of 1975 relative to Section 404 of the Federal Water Pollution Control Act. Being former construction personnel, with little or no background in regulatory functions, they realized that they needed a crash course in wetland vegetation. San Francisco Community College was contacted and before long the first class, a free, nine-week down-to-earth course on salt marsh plant identification was established especially for Corps needs. Over the years the program has grown to where at the present time personnel with varied backgrounds regularly benefit from courses specifically tailored to satisfy the needs of San Francisco District enforcement personnel, engineers, geologists, geographers, environmental resource planners, and others. Essentially the basic purpose of the program is to afford District staff the opportunity to gain general knowledge of wetlands ecology. Because of her continued dedication in teaching Corps employees about wetland plants and animals, the San Francisco District presented Ms. Geary with a special certificate during the summer of 1978.

Besides the filling of the Bay, the dumping of material into it, and the building of structures in and over it, the major on-going problem faced by the District has been the collection and removal of floating debris from San Francisco Bay. A study of this project was begun in 1976 to evaluate methods of reducing the need for continuing drift activities, the costs of which have increased from about $200,000 to more than $700,000 annually over the last 30 years. The study is in progress, but its completion date is indefinite.

*For further information, see Appendix L.

A program of the San Francisco District closely associated to environmental work, and in many ways a part of it, is the shore protection program. The goal of this program is to provide the kinds of works that will prevent wave and tidal current damage to publicly owned beaches, shoreline parks, and conservation areas. Such protection is usually provided by constructing bulkheads, seawalls, or revetments to prevent erosion of shoreline cliffs; by building groins to retain or build beaches; by importing sand to supplement natural beach building processes; or by some combination of these methods.

For many years, the two miles of bay front beaches in the city of Alameda have experienced erosion problems. Although erosion loss has averaged about three feet of beach per year, loss in some areas has been as much as 400 feet. Stabilizing the shoreline of the city of Alameda to prevent further erosion has been under study by San Francisco District for a number of years. Under authority of the Shoreline Erosion Control Demonstration Act of 1974, this beach area was selected as a demonstration project. Upon completion, a two-year period of analysis will evaluate the work.

Near the city of Santa Cruz, studies were completed and about 5,200 feet of seawall was built under a project authorized in 1958. The jetty constructed by San Francisco District at the entrance to Woods Lagoon as part of the Santa Cruz Harbor Project serves as a protective groin for the northern end of Twin Lakes Beach, on which part of the city fronts. Only about $250,000 of an estimated total federal reimbursement of $1,490,000 has been spent to date, because much of the authorized work was classified "inactive" in 1973 due to lack of local support.

Whether it has been the construction of flood control, navigation or other related works, the San Francisco District has long been aware of the complexities associated with water as a limited natural resource and its essentiality to all living things. It has, as well, recognized the need to include environmental analysis and planning as an integral factor in water resources studies and project construction. Over the years, San Francisco District has, in addition to its engineers, accountants, and other "traditional" staff, employed biologists, ecologists, sanitation engineers, recreaton specialists, archaeologists, anthropologists and others who have contributed their expertise to the District's environmental considerations.

Postal Construction Program

A challenging, memorable, but short-lived program undertaken by the San Francisco District was the construction of postal facilities in the Bay Area. It will be remembered that Congress passed the Postal Reorganization Act (P.L. 91-375) during the summer

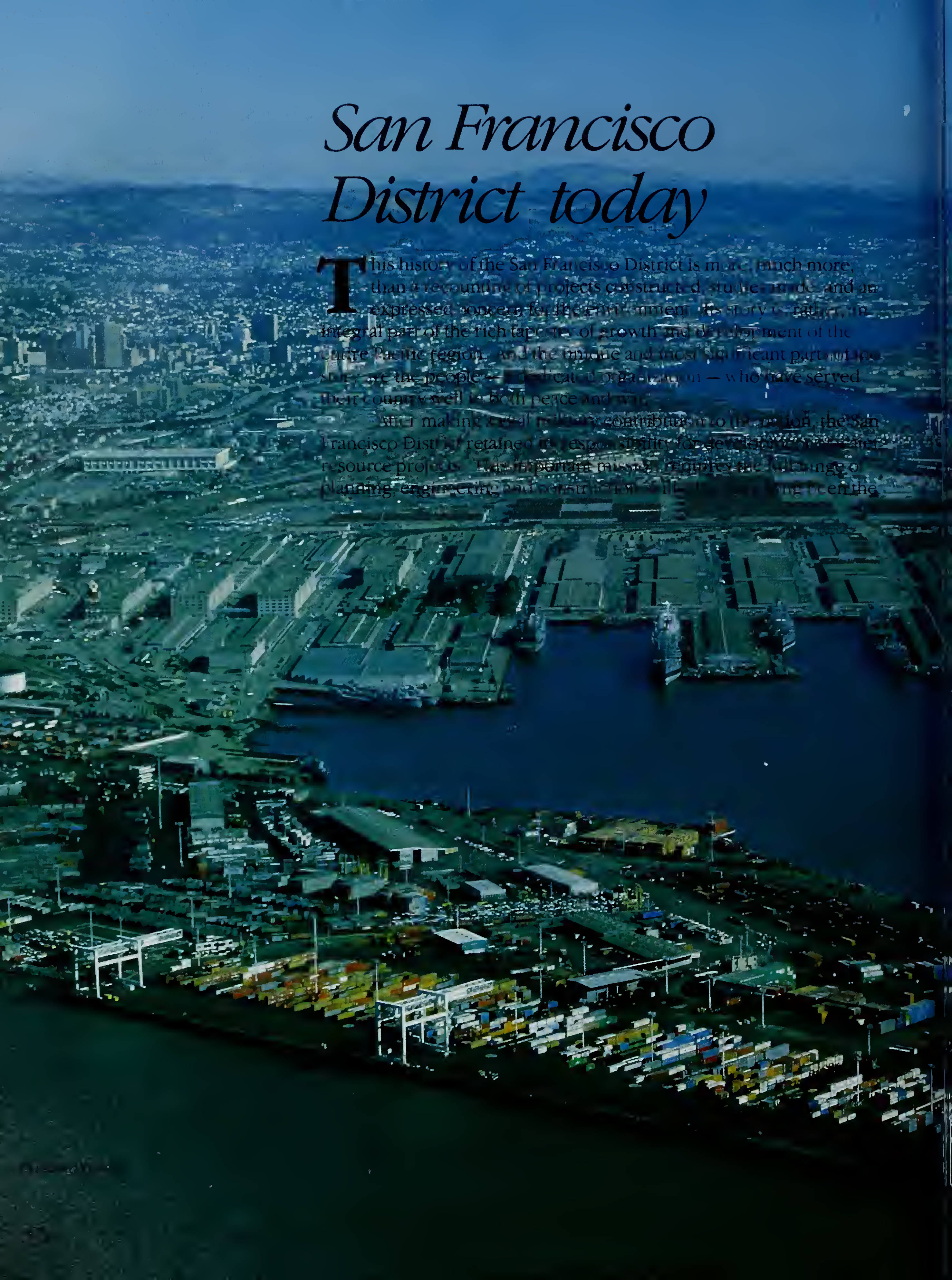
of 1970. The new legislation removed the Post Office Department from the federal establishment and transformed it into a quasigovernment corporation—the U.S. Postal Service U.S.P.S.)

Under its new administrative structure, the Postal Service was to be independent of the federal government; it would be self-sustaining and finance its own operations. So that a smooth transition might be successfully accomplished, the Postal Service was authorized to budget up to $2 billion annually for new and remodeled facilities—a far cry from the $80 million traditionally appropriated by Congress.

This significant increase in design and construction potential suggested that a new approach to design and construction be adopted. Postmaster General Winton Blount, after considering a variety of alternatives, decided to enter into an agreement with Chief of Engineers Lieutenant General Frederick J. Clarke whereby the Corps of Engineers would carry out the design and construction of new postal facilities. Moreover, the Corps agreed to handle real estate activities for the Postal Service, including acquisition, lease servicing and disposal of postal properties.

By the mid-1970s, San Francisco District, in cooperation with and support from Sacramento District, became actively involved in the postal construction effort. The District completed a half dozen facilities during this period; four relatively small renovation projects within the city of San Francisco and two large projects—a bulk mail center located across the Bay in Richmond and the nine-story Western Regional Headquarters building on the peninsula. The bulk mail center cost some $28 million to put up while the Western Regional Headquarters work ran to approximately $9 million.

During the brief period of responsibility (only two years) the district commited a force of three office staff positions and fifteen field staff people to this program. Before things really got rolling, however, the District Engineer received word that the Corps involvement with the Postal Service was to be terminated. It seems that the Office of Management and Budget (OMB) had decided that the Corps of Engineers had more than enough responsibilities and work in other areas and, hence, should get out of the postal construction business. Thus, by 1977 San Francisco, and all other Corps districts for that matter, were relieved of their design and construction duties for the Postal Service. Those who had worked in this arena were transferred to other activities, and San Francisco District once again focused its attention solely upon navigation and flood control projects and the ever-increasing environmental aspects attendant to them.



San Francisco District today

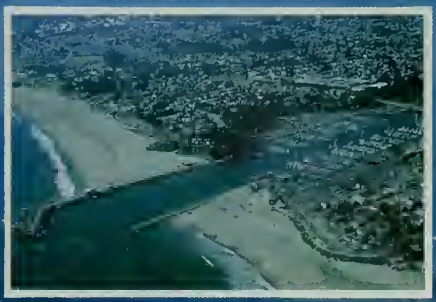
This history of the San Francisco District is more, much more, than a recounting of projects constructed, studies made, and an expressed concern for the environment. Its story is, rather, an integral part of the rich tapestry of growth and development of the entire Pacific region. And the unique and most significant part of the story are the people — a dedicated organization — who have served their country well in both peace and war.

After making a vital military contribution to the nation, the San Francisco District retained its responsibility for developing [illegible] resource projects. This important mission requires the full range of planning, engineering and construction [illegible] been the

hallmark of the Corps of Engineers. As it has for more than a century, the San Francisco District stands today ready to meet the engineering challenges of the present and future. And as new regional and national priorities emerge, the men and women of the District will fulfill their historical pledge — *Essayons* — Let us try.

When the San Francisco District was first established in the 1860s, its boundaries included the entire Pacific Coast west of the Rocky Mountains from Canada to Mexico and the Hawaiian Islands. From this [illegible] the Bay Area.

[illegible] section includes present-day photos of [illegible] along the coast and in the bay [illegible]. Also included are views of the three district projects [illegible] Coyote Dam [illegible] and Warm Springs Dam near Healdsburg [illegible] Sausalito



Santa Cruz Harbor

Redwood City Harbor

Monterey Harbor

Humboldt Harbor and Bay

Moss Landing Harbor

Placing dolosse on Humboldt Harbor's South Jetty

Richmond Harbor

Crescent City Harbo[illegible]

[illegible] and Coyote Dam

Centerline [illegible] oma and Warm Springs [illegible] pose flood control project [illegible] tion in September 1981.

Bay Model Visitor Center

Tour guide explains hydraulic model to school group

Appendices

Hot Shot Technique

Artillerist's Manual, 1860
John Gibbon

To Load with Hot Shot—the piece should be sponged with great care, and the worm frequently passed into the bore. As a precaution, it is well to insert a wet sponge just before putting in the ball.

The muzzle being sufficiently elevated to allow the ball to roll down the bore, the cartridge is inserted, the mouth of the outer bag foremost, the fold down, and carefully pushed home without breaking it; a dry hay wad is placed upon it and rammed once; then a clay or wet hay wad and rammed twice; and finally, if firing at angles of depression, a wad of clay a half-caliber in length, or a wet hay wad, is put on the ball.

The charges for hot shot are from 1/4 to 1/6 the weight of the shot. With small velocities, the shot splits and splinters the wood, so as to render it favorable for burning. With great velocity, the ball sinks deep into the wood, is deprived of air by the closing of the hole, and chars instead of burning the surrounding wood. It should not penetrate deeper than 10 or 12 inches. Red-hot balls do not set fire to the wood until some time after their penetration. They retain sufficient heat to ignite wood after having made several ricochets upon water.

The wads are made of clay or hay. Clay wads should consist of pure clay, or fuller's earth, free from sand or gravel, well kneaded with just enough moisture to work well. They are cylindrical, and one caliber in length.

Hay wads should remain in the tub to soak, at least ten or fifteen minutes. Before being used, the water is pressed out of them.

When hay wads are used, vapor may be seen escaping from the vent on the insertion of the ball; but as this is only the effect of the heat of the ball on the water contained in the wad, no danger need be apprehended from it.

With proper precautions in loading, the ball may be permitted to cool in the gun without igniting the charge. The piece, however, should be fired with as little delay as possible, as the vapor would diminish the strength of the powder.

District Circular

WAR DEPARTMENT
United States Engineer Office
401 Custom House
San Francisco, California
June 18, 1941
DISTRICT CIRCULAR NO. 18-1941

Subject: Plant in the San Francisco District owned by the appropriation "Maintenance and Improvement of Existing River and Harbor Works" (Plant Allotment).

1. Below is a list of all equipment owned by the appropriation "Maintenance and Improvement of Existing River and Harbor Works" (Plant Allotment) of the San Francisco District, (showing book values, rental rates, balances in plant rental accounts, and locations) as of June 1, 1941:

No. & Name of Plant	Daily Rental Rate	Present Location	Book Value June 1, 1941	Available for Repairs
Dredge A. Mackenzie	600.00	San Pablo Bay	814,889.70	−379,903.59
Batch Plant, BP-2001	6.00	Humboldt Harbor	1,177.08	932.87
Conc. Mixer, #33127	1.00	Forts Area	980.00	−79.16
Crawler Carne, CC-58 Osgood	10.00	Humboldt Harbor	2,593.53	2,131.22
Osgood Shovel, #3728	40.00	Humboldt Harbor	16,176.01	13,931.79
Demeritt, H. L.	7.50	S.F. District	9,608.28	2,029.42
Dragline, P & H	40.00	Humboldt Harbor	3,556.05	2,089.36
Generator, Motor	1.30	Humboldt Harbor	173.19	250.01
Hammer, Gas, 724	1.00	Forts Area	120.22	148.92
Hammer, Gas, 744	1.00	Forts Area	120.22	145.89
Paint Spray, Outfit	1.00	Forts Area	145.00	−2.00
Ransome Paver, CMB-12	10.00	Humboldt Harbor	2,175.53	2,222.58
Ransome Paver, CMB 13	10.00	Humboldt Harbor	2,259.44	1,646.24
Paving Breaker, PB-20	.50	Humboldt Harbor	49.03	101.66
Pumpcrete Machines (2)	.50	Forts Area	4,866.67	−133.33
Saw, Machine DeWalt	4.00	Forts Area	158.95	−6.25
Shovel, Bay City	24.00	Forts Area	1,933.33	−1,246.64
Sprayer Asphalt	2.00	Forts Area	132.50	47.00
Tractor, RD-8	24.00	Forts Area	801.68	1,323.14
Tractor, TD-754	16.00	Humboldt Harbor	1,809.56	3,017.92
Tractor, D-4	24.00	Forts Area	3,375.00	156.60
Wagon Drill, I.R.	1.00	Forts Area	633.33	−14.67
Welder, Arc, AW-3	2.89	Humboldt Harbor	314.67	−218.75
West, Welding Mach. Ser. #1336	1.00	Forts Area	577.50	−8.30
Ford Truck, U.S.E.D. 4325	1.50	Humboldt Harbor	200.11	401.40
Int. Truck, U.S.E.D. 4326	3.50	Forts Area	576.72	1,089.28
Chev. Bus., U.S.E.D. 4327	2.50	Humboldt Harbor	567.82	607.92
Chev. Bus., U.S.E.D. 4328	2.50	Humboldt Harbor	567.82	572.88

No. & Name of Plant	Daily Rental Rate	Present Location	Book Value June 1, 1941	Available for Repairs
Int. Truck, U.S.E.D. 4329	3.50	Humboldt Harbor	605.47	1,144.70
Int. Truck, U.S.E.D. 4330	3.50	Forts Area	601.23	1,437.91
Int. Truck, U.S.E.D. 4331	3.50	Forts Area	586.61	1,226.03
Int. Truck, U.S.E.D.4332	3.50	Forts Area	625.68	1,312.66
Int. Truck, U.S.E.D. 4333	3.50	Forts Area	651.52	1,271.35
Ford S.W., U.S.E.D. 4507	1.50	Insp. & Survey Div.	697.00	−12.77
Ford S.W., U.S.E.D. 4508	1.50	Civil Works Div.	697.00	14.56
Studebaker, U.S.E.D. 4512	1.50	District Office	709.81	20.11
Int. Truck, U.S.E.D. 4512	3.50	Humboldt Harbor	285.01	658.86
Int. Truck, U.S.E.D. 4513	3.50	Forts Area	527.34	249.95
Chev. Bus, U.S.E.D. 4514	1.50	Forts Area	400.19	1,221.05
Int. Truck, U.S.E.D. 4515	3.50	Forts Area	524.09	366.66
Int. Truck, U.S.E.D. 4516	3.50	Humboldt Harbor	238.69	1,102.96
Reo Truck, U.S.E.D. 4518	2.00	Forts Area	638.54	2,989.63
Ford Bus, U.S.E.D. 4519	1.00	Forts Area	125.00	2,371.33
Sterling Tr., U.S.E.D. 4520	10.00	Humboldt Harbor	1,102.67	2,338.16
Sterling Tr., U.S.E.D. 4521	10.00	Humboldt Harbor	1,102.67	2,345.54
Sterling Tr., U.S.E.D. 4522	10.00	Forts Area	1,102.67	2,139.91
Graham Sedan, U.S.E.D. 4523	1.50	On loan to Ninth Corps Area	192.22	284.16
Chev. S.W., U.S.E.D. 4524	1.00	Civil Works Div.	144.25	792.10
Int. Truck, U.S.E.D. 4525	3.50	Forts Area	524.09	1,165.50
Ford S.W., U.S.E.D. 4526	1.50	Civil Works Div.	294.95	462.64
Ford Truck, U.S.E.D. 4527	1.00	Forts Area	218.00	114.56
Ford Truck, U.S.E.D. 4528	1.00	Forts Area	218.00	−114.70
Int. Truck, U.S.E.D. 4529	3.50	Forts Area	1,355.17	2,616.75
Studebaker, U.S.E.D. 4530	1.50	District Office	709.81	17.88
Ford S.W., U.S.E.D. 4531	2.00	Insp. & Survey Div.	544.52	722.08
Ford S.W., U.S.E.D. 4532	2.00	Civil Works Div.	544.52	691.48
Ford S.W., U.S.E.D. 4533	2.00	Civil Works Div.	544.52	763.72
Ford S.W., U.S.E.D. 4534	2.00	Insp. & Survey Div.	544.52	797.33
Ford S.W., U.S.E.D. 4535	2.00	Civil Works Div.	544.52	633.26
Ford S.W., U.S.E.D. 4536	2.00	Insp. & Survey Div.	580.53	542.62
Ford S.W., U.S.E.D. 4537	2.00	Civil Works Div.	580.53	741.32
Ford S.W., U.S.E.D. 4538	2.00	Insp. & Survey Div.	580.53	603.23
Ford S.W., U.S.E.D. 4539	2.00	Humboldt Harbor	580.53	623.97
Ford S.W., U.S.E.D. 4540	2.00	Forts Area	580.53	616.96
Buick Sedan U.S.E.D. 4541	1.50	District Office	541.81	268.19
Int. Truck, U.S.E.D. 4542	3.50	Humboldt Harbor	526.58	506.49
Int. Truck, U.S.E.D. 4543	3.50	Humboldt Harbor	527.35	375.52

No. & Name of Plant	Daily Rental Rate	Present Location	Book Value June 1, 1941	Available for Repairs
Int. S.W., U.S.E.D. 4544	2.00	Humboldt Harbor	639.40	519.07
Int. S.W., U.S.E.D. 4545	2.00	Insp. & Survey Div.	694.42	542.59
Chev. S.W., U.S.E.D. 4546	3.15	Insp. & Survey Div.	100.18	687.38
Pontiac Sed., U.S.E.D. 4547	1.50	Forts Area	571.07	327.04
Buick Sed., U.S.E.D. 4548	1.50	Insp. & Survey Div.	424.86	273.57
Int. Truck, U.S.E.D. 4549	3.50	Forts Area	363.99	2,178.05
Trailer, U.S.E.D. 4553	3.65	Forts Area	683.48	−50.17
Buick Sedan, U.S.E.D. 4560	1.50	Division Office	856.76	69.85
Buick Sedan, U.S.E.D. 4561	1.50	Division Office	856.76	103.56
Barge, Boring		Civil Works Div.	416.17	00
Survey Skiff #1		Civil Works Div.	345.61	00
			898,470.09	−308,691.99

2. Attention is called to District Circular No. 3 dated March 26, 1941, which provides that "Distributions of Plant Operations" to be submitted to the District Office Cost Section not later than the last day of the month.

3. The District Office Cost Section should be notified promptly if an item of plant is transferred from one Division to another.

K. M. Moore,
Lt. Col., Corps of Engineers
District Engineer.

District Engineer Col. K. M. Moore
1940-1941 1944-1945 1950-1952

Army Installations

Army Installations within the Nine Counties of the Bay Area 1850-1958

County	Installation	Acres	Use	Period of Acquisition
Alameda	Oakland Army Terminal	602.26	Army Terminal	1940-47
	Alameda Administration Center	99.50	Warehousing	1944-48
	Coyote Hill	79.03	Nike	1953-56
	Lake Chabot (leased)	77.66	Nike	1953-56
	Total	858.45		
Contra Costa	Camp Stoneman	1,842.02	POE	1942-53
	Pacific Ordnance Steel Foundry	44.00	Ord. Plant	1953
	Rocky Ridge	83.91	Nike	1953-56
	Total	1,966.93		
Marin	Fort Baker	1,464.43	Harbor Def. & Nike	1886
	Fort Barry	1,335.52	Harbor Def. & Nike	1886
	Bolinas Mil. Res.	12.90	Harbor Def.	1939-49
	Fort Cronkhite	613.29	Harbor Def. & Nike	1914-42
	Frank Valley Mil. Res.	957.00	Harbor Def.	1923-39
	Stinson Beach Fire Control Sta.	618.00	Harbor Def.	1940-42
	Angel Island	595.50	Nike	1953
	Wildcat Mil. Res.	37.56	Harbor Def.	1939
	Point San Pedro	70.53	Nike	1956-58
	Total	5,704.73		
San Mateo	Devil's Slide	9.61	Harbor Def.	1939
	Little Devil's Slide	13.70	Harbor Def.	1942
	Milagra Ridge Mil. Res.	329.26	Harbor Def. & Nike	1939
	Mussel Rock Mil. Res.	3.94	Harbor Def.	1940-42
	Pillar Point Mil. Res.	12.68	Harbor Def.	1939
	San Bruno	5.24	Nike	1953-56
	Sweeney Ridge	16.66	Nike	1953-58
	Total	390.59		
Santa Clara	USAR Mountain View	7.06	Training Area	1955
San Francisco	Golden Gate Natl. Cemetery	163.99	Cemetery	1938
	Fort Mason	69.86	SF POE	1850
	Presidio SF & Fort Scott	1,382.80	Harbor Def.	1851
	San Francisco Natl. Cem.	55.84	Cemetery	1884-52
	Mt. Sutro	6.23	Nike	1954
	Fort Funston	71.54	Nike	1953-56
	Total	1,750.26		
Solano	Benicia Arsenal	2,201.00	Ord Plant	1862-44
Sonoma & Marin	Two Rock Ranch Mil. Res.	835.68	Radio Receiver Sta.	1943

Speech by Congressman Clem Miller

COYOTE DAM DEDICATION
Ukiah, California
June 6, 1959

This is a tremendous structure. Everyone knows its vital statistics—6 million cubic yards of earth and rock. 53,000 tons of concrete. 160 feet high. 3500 feet long. But it is not simply X-number of dollars and Y-number of hours and Z-amounts of materials. It is much more. It is a monument to many people.

It is, in its very name, a tribute to our very beginnings. Mendocino, Cape Mendocino, earliest such name to come down to us in California—named for Senor Antonio de Mendoza, viceroy of Mexico, and patron of Juan Cabrillo, the explorer of our coastline in 1542.

It is tribute to our early settlers in this very valley—to Thomas and William Potter and Michael Briggs in 1852, antedating the founding of Ukiah by four years.

This dam is a monument to that age of exploration and expansion brought down to the present day. Of vigorous people, of industrial progress, a bounding population and a bright future.

The promise of this whole valley, this entire watershed, requires public works of this sort to give fulfillment, shape and meaning to the individual efforts of its citizens and their forebears.

The people of Mendocino and Sonoma Counties work hard and long to bring prosperity to themselves. With hard work they build up farms and ranches, create businesses and jobs. In return, they have a right to expect that their government will shield them from the public dangers of flood damage and erosion, of stream pollution, of water shortages. They expect, and may properly demand, that their government, county, state, and federal, supply these public services in order that they can continue to prosper in their private pursuits. That the river shall not cannibalize their ranch lands. That it shall not inundate their businesses. That their fishing rights shall be unimpaired. That they shall have healthful water to drink.

It is one of the more unfortunate aspects of modern understanding that this great need for public construction has been subjected to a veritable mountain of objection. We have been told that this is "pork barrel," that we do not have the money—that it is inflationary, that we can't do this, can't do that, can't do the other, when, in actual point of fact, it is more inflationary, and fiscally irresponsible *not* to build these needed public works. Without them, we must limp along with floods, with impure water, with polluted fishing streams, and all the other *costs* which we would have to bear, money costs as many people in the audience can attest to personally.

Inflation is the rise in costs due to shortages. Without Coyote Dam we have to do with *less,* less water, less protection, and this puts a limit on our growth just as surely as if a great hand lowered itself on our valley to suffocate us. Hence, Coyote Dam is an investment, an investment of $20,000,000 in this countryside, a firm plank upon which

a vigorous, thriving private economy can be built. I am quite sure if this were understood by those who presently complain, it would end once and for all the derisive talk about "pork barrel" and inflation. (Don't misunderstand me, inflation is a threat, but not from our public civil works.)

Coyote Dam stands here as the refutation of this theory that we cannot build, we cannot *do* — in this country.

It stands as tribute to the very concept of flood control and water conservation. It is in direct lineal descent from our early efforts to control the ravages of floods in the 1870's. With the setting up of the Mississippi River Commission in 1917, it was only natural that this development should lodge in the Corps of Engineers. To the present time this investment for our protection amounts to a sum of over five and a half billion dollars.

Thus, we in America have unleashed the strength of our government to harness our water resources for our own protection. But the influence is much broader. The effect has been world-wide. Our trained engineers are showing other nations of the world how to create a great capital resource for the benefit of all.

Coyote Dam is a direct tribute to those individuals who perceived that this site in this valley would implement our national water policies.

Congressman Lea, this district's representative for 32 years, began the work in 1939 with an authorization. Then Congressman Scudder took up the work in securing planning funds, and the expenditure of $11,552,000 was authorized by President Truman in 1950. These dry events scarcely acknowledge the patient work of weeks, months and years put in by the many, many people to make this dam possible.

It is a tribute to the energies and vision of the Corps of Engineers, Colonels Tandy, Moore, Walsh, Walker, Goodpasture, Graf and presently Col. Harnett. It was the Corps' responsibility to decide on *this* site. Theirs was the heavy responsibility of choice. It is easy to say that this dam could have been built elsewhere. I am aware of the great debates that have raged over this project, and there is much merit to what has been said in criticism. There has been an honest difference of opinion.

It was the Corps which had to weigh the tangibles and intangibles — to make the choice. Everyone realizes that Coyote Dam is but one piece in the puzzle. That other structures are needed to complete the protection of this great drainage basin. As far back as the authorizing report of 1939, it was known that we must control the tributaries of the Russian River if we would control the flooding. Russian River, Mark West Creek, Sulphur Creek, Dry Creek and so on, are subject to sudden and violent deluge. The peculiarities here present great engineering and site difficulties. The best solution would have been to construct all the works at once, but this is simply a political impossibility. They had to be approached one by one. Successively, they will be conquered. When completed, they will reduce peak flood flows to manageable proportions. A beginning had

to be made somewhere, and Coyote was the logical place to begin.

Now, I have some good news. You will be delighted to know that we are now embarked on the second stage of this flood control project. Yesterday, the House approved $50,000 to survey Dry Creek. This is a victory of the greatest magnitude, because there is a current policy against any new starts. (It is unfortunate that floods, pollution and erosion do not halt upon the promulgation of policies.) So we are grateful, and we can be thankful that our very real needs were considered. While we here rejoice at the opening of Coyote Dam, this pleasure is considerably augmented by the onset of the second stage of development at Dry Creek.

The construction of Coyote we have come to expect as a commonplace of American genius. We are wrong in taking these great structures so for granted. Each one is unique, and Coyote is no exception. It is a tribute to the project engineer, Mr. Charles Beaty, devising means to overcome the inevitable roadblocks to completion. To machines with a finesse and skill that is almost uncanny. One could not help getting a tremendous sense of pride standing near this site while construction was under way to see these marvels taking shape. I can tell you I felt intensely proud. Proud of these men, proud of my government, and of my country.

The dam is finally, a tribute to the organizing genius of our governments. Easy as it may sound, it is not a simple matter to cooperate between levels of government, even with every good will in the world. Local interests are frequently hurt by the broader objectives of regional and national policy. Individual rights are at stake. The Board of Supervisors and officials of Mendocino County, and of Sonoma, patiently working at these difficult problems, have been able to come to that moment where a start was possible and where a successful conclusion has been reached. This was a real partnership where the counties have contributed their share in planning, in organizing and in financing. And the federal officials were able to discover the formula whereby the resources of all of us could be committed to this joint effort. We realize there have been problems unresolved, and injustices still to be righted, (I hear about these in Washington; and we are doing something about them), but in the main, this was a tremendous outpouring of cooperative effort that was crowned with the success of construction.

This is the past. Now, it is a project for use, and for the future. We will see the beneficial effects of our national water policy diffused through the entire region. Water for Santa Rosa, for Petaluma, for Sonoma, for Novato and north Marin. Water, without which we cannot build, cannot provide for our people and its population. Water, spreading its beneficial unifying effects through the Redwood Empire to make it more prosperous.

Moreover, with this distribution system, we can look into the future. To our north lies the Eel River complex with its millions of acre feet and billions of gallons of water, much of which will be available for export. This exciting vista of linking our northern counties with central and southern California is already gaining the attention of our

engineers and planners. Further north, 9 million acre feet of the Klamath River presently waste into the sea. If study proves feasible, the Russian River would provide a ready means of receiving this precious resource, storing it, and distributing it through the Redwood Empire and to the south. It is an exciting and thrilling prospect.

There will be benefits that we will come to accept without thinking much about. Rampaging rivers, once put under control, will soon be forgotten. Water flowing from a tap seems second nature in America. The fact that Coyote made it possible for many of us, will also be forgotten. What will be immediate and visible for all of us down through time will be Lake Mendocino taking shape before us. And Lake Mendocino will spell Recreation.

Our population has exploded in the past few years. According to the demographers we haven't seen anything yet. 50 million *more* Americans in less than ten years. Twenty million people living in California.

Spectacular as our increase in population may be, it is not half as impressive as the leap in recreation. The figures are almost beyond belief. In our National Forests there were 19 million visitors in 1946. Last year they were almost 66 million. An overload of facilities of 40%. (I don't need to remind residents here in Mendocino of this fact as we see what is happening in Mendocino National Forest. $5,000 will be spent this year where we could profitably and wisely spend $100,000.)

The same story is repeated in our national parks. In 1946 there were 24 million visitors, and last year there were almost 60 million visitors, taxing facilities to the breaking point in spite of Mission 66.

The rise in visitors at Corps of Engineer reservoirs has exhibited the most staggering increase of all. In 1950 there were 16 million visitors, and in 1958 there were 85 million. In less than 10 years it will be 180 million visitors. Most of these visits will be to the 3 million acres of water in the reservoirs it has constructed.

Note well, how much more rapidly recreation has been expanding than has population, even though the latter was spectacular. It would make an interesting study to ascertain *why* this has come about. It is undoubtedly due to our increasing family population, rising a third in half a century, to our increasing per capita income, our increasing mobility as a nation, and to our increasing leisure.

It is also due to an increasing *need* for outdoor recreation in and of itself—and for itself. As our population increases since the war has been of the urban variety, there is a greater need to get away from the endless noise and clash and frustration of city life. This *need* to get away, to find peace and quiet will mount higher and higher; it will not decrease.

Thus, the attitude of those of us in government must change and give way. We must abandon the concept of recreation as a frill. Till now, there has been no national recreational policy, and only limited recognition of its need. This must give way. It must be considered as an integral part of any project development because of its essentiality in and for itself.

The Corps of Engineers knows this to be a fact. Their witness, General MacDonnell, has testified to this in the House of Representatives. He reports that the Corps has only been able to invest $10,800,000 on the 138 existing projects for minimum recreation facilities. This figures out to 12 cents per visitor day. It desperately needs $9-1/2 million right now for the most urgent work on our present projects. This would amount to only 24 cents per visitor day. It is hard to believe that this would not be worth every penny for the sheer pleasure it would give alone. Remember, these 3 million acres of reservoir now have 80 million visitors a year, and will have 180 million in less than ten years.

However, this is not the only consideration. From figures already stale in 1956, we learn that recreation is a $20 billion business. Of this amount Americans spent 4 to 5 billion on *outdoor* recreation. Thus, there is a solid economic rationale upon which to base the recreation development of Corps reservoirs, now to include our own Lake Mendocino.

And recreation spending is bounding up at a rate of 8-10% per year. With this increase goes a steadily mounting strain on our resources. They are worn out with intensive over-use. Campsites, landing ramps, are destroyed. Soil is compacted. Trees are uprooted.

In the fact of these staggering facts, what we *are* doing, what we are planning to do, is a pitiful story. Operation Outdoors of the Forest Service, for example, is 60% behind in execution of its plans; and is 50% behind in concept. The plan called for 40,000 new camping units by 1962. We now need 20,000 more than that figure, but have only built 6,000. It is the same story for Mission 66, the program of the National Park Service. It is 30% behind in its estimate of what the need would be, and 50% behind in its achievement of the goals it set for itself. We have already set out the sorry details in projects of the Corps of Engineers. For years, the Corps has struggled along with no consideration from Congress for the recreation needs at reservoirs. Last year, *for the first time*, Congress acknowledged, with a line item of $275,000, a sum to be ear-marked for recreation planning.

This is the record of the past. What of the future? According to the experts we must acquire forty times what we presently have in recreation areas to keep up with population, leisure time and increased incomes. Yet, there are no present plans for acquisition at all. In repair and new construction we are falling steadily behind. According to the Sports Fishing Institute we are accomplishing only 1% of what we could accomplish, federal, state and local. This is our prospect.

People say—why should we spend to supply recreation? Well, those people should be advised that recreationists pay their own way in our civil works program. A recent report indicates that government may realize as much from recreationists as it received for the power the dam may generate, and for which the project was originally built. Other people say that we should let local government do the job. I say local government is doing its share. You would be interested in knowing that local government spends a $1.36 for these projects for

every 10 cents spent by the federal government.

Mendocino County is now bending to the job of Lake Mendocino. It is working out a recreation plan. It is committing its resources. The Board of Supervisors, the Chamber of Commerce, the civic-minded people, and the businesses of the area, are seeking ways to make Lake Mendocino a recreation attraction of the first rank.

It is my view that we need more. In my mind the federal government, which had the biggest stake in putting this Lake here, has the obligation to see that its recreation potential will be fully developed. In cooperation with the County of Mendocino, yes. But with the final responsibility itself. And to date the federal government has shirked its responsibility. It has thrown the load on local government. It has no recreation policy. It has no coordination of goals. It has not begun to even grapple with the problem.

This means new horizons in Congress. It means a recognition that recreation is a necessity, that it has value in and for itself. It demands recognition that recreation is an asset, exactly like money in the bank, an investment in health and well-being, as well as an economic asset, an investment in the area; that it is not just a federal cost. It demands recognition that recreation is a business with economic significance in exactly the same sense as steel or bricks or autos.

When we tell the Engineers to develop a damsite, they must be instructed to consider the land needed for recreation in their plans. We have been building our reservoirs with no attention to the modest recreation needs, and so we have made reservoir planning almost impossible in many cases. They must receive the necessary funds to plan, to construct, and, if necessary to operate the project until local government can take it over. Sufficient funds must be provided to maintain the area in reasonably good condition. No matter how incomparable the site, an area gutted by lack of care and over-use is a liability, not an asset, a social cost that we pay and pay for many times over.

These are problems to which federal policymakers must address themselves. This is the high task of the National Recreation Resources Review Commission, now at work. We wish them well, and may the Commissioners bring some sense of urgency to their work.

Coyote Dam stands as the monument to many, many devoted people, a great number of them here today. Lake Mendocino stands as the great challenge of the future. I know that the people of Mendocino, of Sonoma, their elected and appointed representatives, and of the nation, are going to meet it.

From the office of
Congressman Clem Miller
First District, California
135 House Office Building
Washington, D.C.

Flood and Storm Damages

Summary of Flood and Storm Damages (December (1964)
San Francisco District by Basins, Totals
($1,000)

	Smith River	River & Tribut.	Klamath Redwood Creek	Mad River	Eel River & Tribut.	Coastal Streams	Russian River & Tribut.	Totals
FLOOD:								
1. Residential	600	4,600	100	100	4,800		5,800	16,000
2. Commercial	200	4,600	400	300	3,300	200	3,100	12,100
3. Public Facilities	1,200	6,900		800	2,000	100	200	11,200
4. Public Utilities	200	3,600			1,600	200	100	5,700
5. Agriculture	1,900	4,600	300	1,300	12,200	900	3,700	24,900
6. Bank Erosion		700			300	100	1,200	37,000
7. Roads and Bridges	5,100	17,100	100	1,000	12,000	500	1,200	37,000
8. Industrial		2,300	200	900	12,800	500		16,700
9. Livestock	100				1,400			1,500
10. PL/99		500		500	800		400	2,200
11. PL/875	2,000	6,200	100	1,400	6,000	300	1,400	17,400
12. Emergency Aid	400	600			1,700		500	3,100
13. Railroad					14,600	100	200	15,000
14. Miscellaneous			100	100		200		500
Totals	11,700	51,800	1,300	6,400	73,500	3,100	17,000	164,800
STORM:								
Roads and Bridges	500	19,800		1,400	5,700	700	200	28,300
Railroad					2,400			2,400
Totals	500	19,800		1,400	8,100	700	200	30,700
Total Flood and Storm	12,200	71,600	1,300	7,800	81,600	3,800	17,200	195,500

Summary of Flood and Storm Damages (December (1964)
San Francisco District by Counties, Totals
($1,000)

Item	Siskiyou County	Humboldt County	Del Norte County	Trinity County	Mendocino County	Sonoma County	Klamath County, Oregon
FLOOD:							
1. Residential	600	6,200	2,900	400	200	5,500	
2. Commercial	900	4,800	2,700	300	500	2,900	
3. Public Facilities	300	8,500	2,000	200	100	200	
4. Public Utilities	2,900	2,000	300	200	100	100	
5. Agriculture	1,900	14,000	2,600	600	2,000	2,500	1,400
6. Bank Erosion	600	400			200	200	
7. Roads and Bridges	5,100	23,200	6,200	1,300	700	600	
8. Industrial	300	15,300	100	100	800		100
9. Livestock		1,400	100				
10. PL/99		1,400		100		400	400
11. PL/875	2,200	10,300	2,400	1,000	1,100	400	
12. Emergency Aid	400	1,700	400	200	400	200	
13. Railroad		7,300			7,500	100	
14. Miscellaneous		100	100		100		100
Totals	15,200	96,600	19,800	4,400	13,700	13,100	2,000
					Flood Total:		164,800
STORM:							
Roads and Bridges	2,200	10,000	600	10,800	4,600	100	
Railroads		1,000			1,400		
Totals	2,200	11,000	600	10,800	6,000	100	
					Storm Total:		30,700
Totals, Flood and Storm	17,400	107,600	20,400	15,200	19,700	13,200	2,000
					Flood and Storm Total:		195,500

Salinas River Basin Floods

1969 Salinas River Basin Floods
Chronological Summary

1964 — House of Representatives passed resolution requesting SPN to prepare flood control report on the Salinas River.

1969	Jan 19-22	First storm in basin
	Jan 25	Photo flight over Salinas basin (a total of 4 were made in January and Feburary)
	Jan 25-27	Second storm in basin
	Jan 26	SPN dispatched four teams of three Corps of Engineers "observers" each to basin; SPN established "alert center"; SP Division Engineer and SF District Engineer made aerial reconnaissance of "Salinas and San Joaquin Valleys"; and Carmel River peaked.
	Jan 27	Photos of Salinas dam were made
	Jan 28	Monterey County was declared a disaster area by the Governor of California; "severe erosion problem" noted on Nacimiento reservoir dam; San Antonio reservoir dam "outlet conduit" collapsed;
	Jan 28	San Luis Obispo County was declared a disaster area by the President; and five SPN observer teams now active in flood area
	Jan 29	Salinas flood photos sent Congressman Talcott and Mr. Burns, now acting OEP regional director
	Feb 2	California disaster office arranged meeting of OEP with Monterey County representatives in Salinas
	Feb 5	SPN asked SPD for $120,000 to investigate and report on January flood damage on Salinas and Carmel rivers.
	Feb 10-14	Special House public works committee "held three flood damage hearings in California"; Chief of Engineers flew over damaged area; and SPN monumented January flood damage.
1969	Feb 17	SPN met with Monterey County Water Advisory Committee in Salinas
	Feb 18	Monterey County requested SPN to restore levees on Pajaro and Salinas rivers
	Feb 24-26	Third storm in basin
	Feb 26	SPN team sent to Salinas River area to collect data on Jan 25 flood; SPN estimated damage in San Luis Obispo County at $1,600,000; and

	SPN estimated Salinas River basin damage due to January and February floods at $18,000,000.
1969 Mar 7	SPN sent "reconnaissance report" on Salinas basin to SPD
Mar 19	Scheduled prior to floods of January and February, SPN held public hearing in Paso Robles and heard "an almost endless line of resolutions...to justify a Corps of Engineers project" in the Salinas River watershed offered by residents
Mar 20	Scheduled prior to January and February floods, SPN held public hearing in Salinas; inspected Salinas, Nacimiento, and San Antonio dams and nearby flood-damaged areas
Mar 21	SPN met with San Luis Obispo County supervisors in Paso Robles; inspected nearby flood-damaged areas earlier in the day.
Mar 26	SPN photographed Texaco oil field at San Ardo
Apr 14-15	Douma of OCE inspected Salinas, San Antonio, and Nacimiento dams
Apr 15	San Luis Obispo County supervisors and others asked SPN for "investigation" of floods in Salinas River basin; SPN and SPL arranged to split flood repair responsibilities in Salinas River basin.
May 5	SPN inspection of Salinas River basin damage continues
1969 May 9	SPN advised Southern Pacific Railroad of proper procedure to request Federal assistance to re-channel Salinas River where it had damaged railway; SPL asked SPD for money to repair damaged Salinas dam before it fails in another storm such as "last winter".
May 23	SPN advised San Luis Obispo County flood control and water conservation district that its "reconnaissance investigation on the upper Salinas River" does not justify a small flood control project under the 1948 flood control act but that SPN will continue its "entire Salinas River basin...overall study".
Jun 19	SPN met with San Luis Obispo County flood control and water conservation district and, shortly thereafter, at the district's request, provided an estimated timetable on when reports might be expected.
Sep 4	SPN facilitated a special arrangement with construction workers' union so Nacimiento spillway

		repair contract could go forward despite a construction union area strike.
	Sep 5	Twenty-first repair contract awarded by SPN, of which 16 have been completed and 5 are in process as of Sep 4.
	Sep 10-11	OCE, SPD and SPN inspected and photographed valve in San Antonio dam.
	Oct 6	Twenty-fifth repair contract awarded, of which 20 have been finished and 5 are in process as of Sep 30.
	Dec 30	SPN's "plan of survey" of Salinas River basin was forwarded to SPD. It estimated agricultural damage from January and February floods at more than $17,500,000 and total damage at $32,000,000. It reported Federal governmental expenditures under PL 99 and 875 for repair of damage in Monterey and San Luis Obispo Counties in floods at $3,940,000.
1970	Jan 26	Thirty-three flood damage contracts have been let to date of which 26 have been completed and 7 are in process. Two are planned for later. Total estimated cost of work completed to date is $1,200,000.

Flood Repair Contracts

Salinas Basin Flood Repair Contracts Let By SPN (In Chronological Order) 1969-70

Award Date	Bid Amount	Purpose	Contractor
1969			
Feb 20	$ 27,822	Nacimiento spillway restoration	Podesta Divers, Inc.
Mar 25	40,089	Sewage repair, Soledad	Calabrese
Apr 7	38,400	Sewage repair, King City	Kimko
Apr 10	80,000	Sewage repair, Gonzales	Henningsen
Apr 15	18,500	Nacimiento cofferdam	Donovan
Apr 17	53,000	Sewage repair, Salinas	Calabrese
Apr 21	4,680	San Antonio piezometer	Smees
Apr 21	9,340	Toro Creek restoration	Graves
Apr 21	164,060	Sewage repair, Chualar	Ekelind
Apr 28	17,987	Lewis Cr. bridge	McGray
May 22	41,000	Interlake and Nacimiento roads	Watkins
May 28	39,810	Vineyard Canyon road	Peterson
Jun 9	72,856	Big Sandy Road	Burke
Jun 19	66,614	Coalinga and Clear Creek roads	Donovan

Jun 27	69,840	Indian Valley Road	Donovan
Jul 11	47,267	Lewis Creek Road and Hepsedam	McGray
1969			
Jul 18	50,232	Salinas #2	G. & T.
Jul 29	44,805	Salinas #1	Calabrese
Jul 31	859,000	Nacimiento spillway	Hensel Phelps
Aug 4	36,620	Salinas #3	G. & T.
Sep 4	50,055	Salinas #4	G. & T.
Sep 4	76,480	Salinas #6	Donovan
Sep 5	110,115	Salinas #5	G. & T.
Sep 8	41,500	San Lorenzo Creek	Henningsen
Oct 1	11,990	Salinas #7	Donovan
Nov 28	22,957	Salinas #8	Donovan
Dec 16	14,967	Salinas #9	Gold Coast
Dec 22	10,380	Salinas #12	Donovan
Dec 22	5,774	Salinas #10	Beck
Dec 29	10,120	Salinas #11	Henningsen
1970			
Jan 7	9,175	Salinas #13	Calabrese
Jan 16	17,044	Salinas #15	Calabrese
Jan 21	39,080	Salinas #14	Gold Coast

Remarks by Colonel Allan

REMARKS BY COLONEL ALLAN
SAN FRANCISCO-OAKLAND
KIWANIS CLUBS
FAIRMONT HOTEL — 23 JUNE 1964

What is the Bay?

Discussing — even defining — San Francisco Bay is a dangerous occupation. Plans for its development have occupied the minds and imaginations of western man since it was first observed; small plans, large plans, wise plans, foolish plans. But few of these planners have had the same view; fewer still possessed historical perspective; and none has had the physical knowledge of the bay on which to base assurance of success.

When I look at the bay I am conscious that I am responsible for the preservation and enhancement of navigation; the shipowner agrees. The industrialist sees it as a supporting element to industry; the biologist, as a spawning and feeding area for fish and the habitat of marine life. The homeowner sees its beauty and serenity; the builder sees homes. The recreationist sees sails and aquatic sports; officials see a source of revenue. Different eyes, different interests — no plan can satisfy them all.

District Engineer 1963-1966
Col. Robert H. Allan

The Changing Bay

The bay, in its present form, has been a natural phenomenon for 12,000,000 years, although three times it has risen above sea level. The last submergence was about 1,000,000 years ago, so will say the bottom of the bay has seen no light for a million years. I reiterate this figure because now we know that the bay may change more in the next hundred years than it has in the last thousand millennia.

Even now, the bay is constantly changing.

In the course of nature, 10,000,000 cubic yards of silt come into the bay each year, most to swirl uneasily in the currents of the bay, settle gently, and then, disturbed again, flow aimlessly in labyrinthine currents which never flow freely to the sea.

The man-made changes pose the hope, the challenge, and the threat.

Navigation channels change the shoaling and salinity patterns of the bay.

Upstream reservoirs choke the flow of fresh water into the bay and salinity increases year by year in San Pablo and Suisun Bays, and salt threatens the delta.

Sewage effluent, waste waters and debris have destroyed fisheries, wildlife and vegetation. The clam beds and shrimp of the South Bay are gone, and our own health will eventually be threatened if no counter-measures are taken.

Finally, the fill in the bay is changing the tidal prism, water currents and velocities, and shoaling patterns.

The bay is changing, and we *must* give direction to that change.

The Planners

We *can* give direction, because for the first time in his history, man can make major changes in his environment; there is no question, I believe, but that water from Canada and Alaska will one day give life to Mexican deserts. The Parsons plan says this is today economically feasible. Unless we apply the same foresight to the bay, we will see our own environment changed vastly for the worse.

There is encouraging evidence that a start has been made. The Association of Bay Area Governments, 8 counties and 70 cities, has received a Federal grant of $171,000 for regional planning in the nine bay area counties. They will add $85,000 of their own, in salaries and services, in order to produce a plan for development of this area, with the first priority given to a recommendation on shoreline use. This plan is to be developed in two or three years. They recommend a three-year moratorium on fill, but exclude all areas covered by municipal and local master plans. This exclusion, with others, and the lack of enforcement authority, make the moratorium of little force and consequence unless each individual member, passes an enforcing ordinance.

Working with ABAG for the next six months will be the California State San Francisco Bay Conservation Study Commission

authorized in the last legislative session. With a budget of $75,000, this commission will recommend action on regulating the bay development to the State legislature next January. The commission, yet to be appointed, will consist of nine members, three appointed by the Governor, six by the legislature.

The Assembly Committee on Natural Resources — the Z'berg Committee — will continue hearings on bay fill. I'm presenting testimony, which you're hearing today, at their session in San Jose, July 9th and 10th.

There is also a $4,000,000 regional transportation study beginning; (37 members: Bay Area Transportation Study Commission) we have the State's Bay Regional Water Pollution Control Board attempting to preserve the quality of bay waters; and the district Air Pollution Control Board administering regulations in that area. I will discuss my own planning function later.

With all this authority, there is a missing link, overall direction. There is no agency, representing the people of the bay area, to give guidance, coordination and *control* to development.

The Planned-For

One hundred, even fifty, years ago, planning was for today, and literally, tomorrow. We planned for ourselves and those of our children who lived. Today we plan for fifty years in the future; tomorrow we must plan for a hundred; eventually, we must see a thousand years in the future if civilization is to advance and not deteriorate.

The time will come when every birth, every new victory over disease, will constitute a drain on the diminishing resources of the planet. We must use them wisely.

We are now 3.7 million people in these nine counties; in thirty years we shall be 7.4 million; in sixty years 14.4 million.

Just as we owe a debt to the past, we must extend credit to the future. These are the people we must plan for.

Bay Study

This brings us to our San Francisco Bay Survey and our model operations in Sausalito. Stated as simply as possible, the purpose of this study is, first, to tell the local people what can profitably be accomplished in using the natural resources of the bay area, and, second, to furnish the basic information and analysis required to plan effectively.

To date we have produced 57 volumes including the work not only of the Corps, but 21 other State and Federal Agencies. We have enlisted the help of these other agencies in order to get the best information available from specialists in fields in which we're not particularly qualified. In addition to State agencies, including the University of California, we contracted for information from the Dept. of Commerce, Public Health Service, Fish and Wildlife Service,

Geological Survey, Dept. of Agriculture, National Park Service and many others.

As one example, the Office of Area Development of the Department of Commerce provided us with detailed estimates of the future population, economy, and land use on a decade-to-decade basis, and told us what the population distribution and land-use patterns are likely to be township by township. This gave us data on who, what, when and where to plan for; this was part of our economic yardstick in evaluating what could and should be done.

Our study covers areas of navigation, flood control, water conservation, salinity intrusion, land reclamation and transportation and recreation. In our Technical Report on Barriers, issued last July, all of these items were considered in conjunction with solid-fill barriers across the bay.

Taking data from both nature and our model investigations in Sausalito, described in the brochure you have before you, we evaluated eight barrier plans: Chipps Island; Dillon Point; Point San Pablo; Reber Plan; Savage Plan; modified Nishkian Plan; Sierra Point-Roberts Landing; and Dumbarton.

Frankly, I couldn't summarize the results of these 57 volumes even if I took the rest of the afternoon, so I'll mention only those results which may be of ultimate importance to you.

We found, at this time, that the major value of any barrier would be in the conservation of water and the prevention of salinity intrusion. The plan that best accomplishes these ends is the Chipps Island barrier.

What water would it save?

You must consider that when most of the elements — the reservoirs and distribution systems — of the State Water Plan are built that there will be little or no uncontrolled flows in the Sacramento and San Joaquin Rivers. These river beds will serve only as pipelines, or aqueducts, for the transport of water from one area to another.

It will be releases from these planned reservoirs that will form a hydraulic barrier against the intrusion of salinity into the delta and beyond. Even now, releases from Shasta and Folsom Dams, for this purpose, approach 1,000,000 acre-feet annually, or a minimum flow of 3,800 c.f.s. We think the amount required for the same purpose 50 or 60 years from now will be 7,500 c.f.s. This increase would be due to two factors: First, there would be no uncontrolled flows in the rivers to augment the releases from upstream reservoirs. Second, increased pumping at Tracy, for water transfer south, will change the water slope, drawing salt water toward the south and west parts of the delta. We feel, therefore, that by 2020 a barrier at Chipps Island would conserve 4,775,000 acre-feet of water a year. In addition, a barrier would furnish a positive salinity control that would solve the problem of transporting water across the delta under the California Water Plan.

There are two other proposed projects to accomplish this transport: the State Delta Water Facilities Plan and the Bureau of Reclamation's Peripheral Canal Plan. These are now being evaluated

by the Delta Inter-Agency Committee which will recommend a plan in June and release its report in December.

The bay model noted changes in tidal ranges, currents, and shoaling which would be caused by barriers so that these changes could be evaluated in terms of costs. For example, the range at the Chipps Island site would increase 1.5 on the high side, 2.3 on the low, for a total of 3.8 feet if a barrier were built there.

Before coming to our land reclamation or bay fill problems, I might mention that the model is extremely useful in testing remedial measures to prevent shoaling. We now spend $2,500,000 a year maintaining bay shipping channels. Our model should show us how to save enough of this cost to pay for our entire study in a very few years.

History of Bay Fill

The total water area in San Francisco, San Pablo and Suisun Bays is 437 square miles. This shrinks to 137 miles at minus 18 feet; in other words, 70% of the bay is less than 18 feet deep.

The total area of marsh, tidal and submerged lands susceptible to reclamation 100 years ago was 568 square miles. Marshland is defined as the area from mean high tide to 5 feet above mean sea level; tidelands, from high tide to low tide; and submerged lands from mean high tide to a depth 12-18 feet below mean sea level.

Between 1850 and 1957, 243 square miles of the 568 possible have been reclaimed. The trend can be seen from the annual rate of fill:

1850-1900 — 1.6 sq. mi.
1900-1925 — 2.4 sq. mi.
1925-1940 — 2.9 sq. mi.
1940-1957 — 3.6 sq. mi.

We've made no field studies since 1957 but from the evidence around us we know that reclamation is continuing at a rapid rate: In San Mateo County alone about 6 sq. mi. have been reclaimed since 1957.

Of the 243 reclaimed square miles, 40% are in San Francisco Bay, 30% in San Pablo Bay, and 30% in Suisun Bay. If you look at the black area on the small chart you can see the extent and distribution of reclaimed land.

I don't want to mislead you so I want you to note that about 93% of the reclaimed land has been marshland. This amount is, however, 57% of the total marshland which could be reclaimed, reducing the wildfowl and wildlife habitat to that degree.

About 75% of the reclaimed land is used for salt ponds, recreation and agriculture.

The pressure for filled land for other uses is growing, however. Remember our Commerce Report projects a fourfold population increase, from 3.7 to 14.4 millions. Flat land in the neighborhood of large urban areas is generally in demand for a variety of purposes.

While this same Commerce Report notes that 2,400 sq. mi., or about 65% of the 3,600 sq. mi., of potential urban land will be in urban use, leaving 35% still to be developed. Much of this 35% will be hilly.

If the rate of reclamation of tide and marshlands continues as it has in the 1940-1957 period, about 200 out of the 250 square miles of tideland remaining would be reclaimed in the next 55 to 60 years.

Model Test Results

We have recently conducted tests on our bay model to find out what would happen if all land in the north and south bays were reclaimed to a depth of 12 feet. Twelve feet, we feel, is the limit of economical fill.

First, in the south bay alone:

The tidal range is decreased in the extreme south by about 1.6.

Current velocities in the south bay are reduced from 50 to 90 percent; from 25 to 35 percent in the Golden Gate; 35 to 70 percent at Point San Pedro, just north of San Rafael; and lesser amounts in Suisun Bay.

Salinity is decreased slightly throughout the bay system.

Second, with reclamation to the 12 foot depth throughout the bay:

Tidal ranges in the extreme south bay, at Alviso, are decreased 1.2 feet with ranges in the remainder little affected.

Current velocities are reduced 70 to 90 percent in the South Bay, 35 to 75% in the Golden Gate, with smaller reductions throughout the North Bay system.

Salinity is slightly reduced in the South Bay, but there would be an increase in North Bay salinity with increased intrusion into the delta area.

When tests were made of reclamation to the six foot depth, the same results were noted, to a somewhat lesser degree.

From these tests, then, we can generalize that full reclamation would affect shoaling patterns — decreased current velocities depositing more sediment — tidal ranges, velocities, and water quality.

The last factor is very important in the south bay, which, even now, has a very poor circulation system. It quite often takes at least 20 days for any trace of a pollutant introduced in the South Bay to reach the Golden Gate; some never does.

The only flushing action is caused by the tides; the implications of reduced current velocities are ominous and could be extremely detrimental. It is true that changes for a single reclamation project might be scarcely perceptible — but where do we draw the line? Even with no further fill, I think eventually it will be necessary to route all wastes to the sea.

Factors Affecting Reclamation

The type of development likely to use the bay shores, tidelands

and submerged lands is important to an analysis of planning for shoreline development.

I think the most important type is port and navigation development. Flat land adjacent to a deep water harbor is essential for the efficient operation of ports handling ocean-going vessels. We don't anticipate a large number of new ports in the near future, but improvements will be made to those we have. We may eventually have new ports in the North and South Bays owing to the establishment of industry, however

The necessity for disposal areas for spoils dredged from navigation channels is also of great importance. This is true not only of new projects (Oakland, Redwood City) but we may find it desirable in the future to dispose of maintenance spoils as cheaply as possible. If this becomes necessary, the need for disposal areas may exist for the indefinite future.

Reclamation of bay lands for recreational and associated uses is a development rapidly increasing in significance. Population growth will force an increase in the square mileage of recreational area available to the public around the bay.

Preliminary plans for waterfront development in Alameda, San Mateo and Santa Clara are multi-purpose, including not only parkways, but small craft harbors, picnic areas, nature areas, docking areas, and facilities for boat repair. Total reclamation needs for recreation purposes may well eventually exceed all other requirements.

Freeways, bay crossings, shorelined access roads, and other transportation structures press claims for fill construction as necessary and economical.

Airport development continues.

Industrial and residential use forms another category. Here we expect economics to play a part. The cost of filling tide and submerged land ranges from \$25,000 to \$35,000 an acre; even with this initial cost, expensive foundation treatment is necessary to provide stable structures on this type of fill ground. And yet it continues.

Conclusion

These are some of the conflicts.

The extent of changes in the present shoreline of the three bays should depend, however, not only upon what will prove to be socially justifiable and economically feasible during the coming decades, but also on what should be set as the desirable minimum water area of the present three bays.

Once reclamation is accomplished, the process is practically irrevocable and results in irremediable physical effects. Reclamation in some areas may be desirable, in others, inimical to the physical, social, and aesthetic development of the bay area.

The only control my office can exercise over fill in the bay is from the standpoint of its effect on navigation or the introduction of pollutants.

I should think, in view of the large number of public entities concerned in bay development, and the extent of marsh, tide and submerged lands in private ownership, that it is apparent that the control of bay fill would require some sort of overall cooperative authority. We must, in addition, have a coordinated plan to serve as the basis for regulation.

I know that the material we have developed from our bay study is essential in the development of such a plan. We will give our complete cooperation to ABAG or any other entity, responsible in whole or in part, for the formulation of a program to improve where possible, and preserve where necessary, the values we have found in living around this magnificent bay.

Warm Springs Dam and Lake Sonoma

Warm Springs Dam and Lake Sonoma General Information

GENERAL	
Location:	At the confluence of Warm Springs Creek and Dry Creek, approximately 10 miles northwest of Healdsburg, California (Sonoma County) Section 18, NE/4, Skaggs Springs 7-1/2′ Quadrangle
Purpose:	Flood Control — Water Supply — Recreation
Project Area:	17,615 acres (71 million square meters)
DAM	
Type:	Compacted earthfill with impervious core
Height:	319 feet (97 meters) (Crest Elevation: 519 feet msl)
Length:	3000 feet (915 meters) at crest
Width:	Top — 30 feet (9 meters) Bottom — 2600 feet (793 meters)
Volume:	30 million cubic yards (23 million cubic meters)
Cofferdam Height:	200 feet (60 meters) (Elevation: 392 feet msl)
SPILLWAY	
Type:	Ungated overflow
Elevation:	Crest — 495 feet msl Flood — 513 feet msl
Capacity:	29,600 cubic feet per second (838 cubic meters per second) (13 million gallons per minute)
OUTLET WORKS	
Tunnel:	Intake length — 500 feet (152 meters) Intake diameter — 10 feet (3.0 meters) Outlet length — 2900 feet (884 meters) Outlet diameter — 14 feet (4.4 meters)

Control Structure:	Height — 307 feet (82 meters) Diameter — 36 feet (11 meters) to 56 feet (17 meters)
Capacity:	7,100 cubic feet per second (3 million gallons per minute)
Low Flow:	Elevations — 350 feet msl, 390 feet msl, 430 feet msl Diameter — 5 feet (2.1 meters)

RESERVOIR

Drainage Area:	130 square miles (337 million square meters)
Capacity:	381,000 acre-feet (470 million cubic meters) (124 billion gallons) Flood Control — 130,000 acre-feet (160 million cubic meters) (42 billion gallons) Water Supply — 212,000 acre-feet (262 million cubic meters) (69 billion gallons) Sediment Accumulation — 26,000 acre-feet (32 million cubic meters) (9 billion gallons) Fishery Maintenance — 13,000 acre-feet (16 million cubic meters) (4 billion gallons)

LAKE SIZE	Flood Pool	Conservation Pool	Minimum Pool
Elevation	495 feet	451 feet	292 feet
Surface Area	3600 acres	2700 acres	486 acres
Shoreline	75 miles	53 miles	17 miles
Length:			
Dry Creek	12 miles	9 miles	5 miles
Warm Springs	7 miles	4 miles	2 miles

FISH HATCHERY	Mitigation	Enhancement
Annual Production:		
Steelhead	300,000 yearlings	—
Silver Salmon	10,000 yearlings	100,000 yearlings
Chinook Salmon		1,000,000 smolt

RELOCATIONS:

Roads:	24 miles of new roads plus three new bridges
Utilities:	15 miles of electric power lines; 9 miles of telephone lines

Warms Springs Dam and Lake Sonoma Contracts

Work Item	Contract No.	Contractor	Value ($1000)	% Complete	Completion Date
Unit No. 1 Roads	68-C-008	Wunderlich Co.	979.3	100	October 1968
Horizontal Drains	69-C-0019	Jensen Drilling Co.	18.3	100	January 1969
Access Tunnel	70-C-0084	Gates and Fox Co.	324.4	100	April 1971
Cemetery Relocation	70-C-0095	Frank Donovan	8.3	100	July 1970
Unit No. 3 Road, Random Fill, Bridge Substructure	70-C-0099	Piombo Corp.	6,630.2	100	May 1974
Admin. Facilities	71-C-0011	Dunn and Gaulke	418.3	100	September 1971
Bridge Substructure	71-C-0037	Willamette Western Corp.	4,295.4	100	December 1973
Unit No. 2 Road	71-C-0057	Piombo Corp.	4,418.1	100	May 1974 (T)
Landscaping	72-C-0013	Frank Donovan	9.8	100	June 1974
Embankment/Stage I	73-C-0002	Piombo Corp.	5,241.6	100	May 1974 (T)
Rec. Area Planting	74-C-0019	Environmental Dev.	18.9	100	June 1974
Sheep Fencing	74-C-0029	J. R. Pope	24.0	100	January 1974
Outlet Works	74-C-0070	S. J. Groves & Sons	272.5	0	May 1974 (T)
Rec. Area Planting	75-C-0057	Honda Landscaping	27.2	100	November 1975
Unit No. 1, 1A, 2, 3, 4 and Access Roads	77-C-0018	Piombo Corp.	4,900.6	45	November 1978
Dam and Outlet	78-C-0035	Auburn Const.	128,400.0	56	April 1983
Fish Hatchery & Visitor Center	79-C-0007	Swinerton and Walberg	8,500.0	73	December 1980
Disposal Area No. 7	79-C-0068	Piombo Corp.	149.5	100	October 1979
Electrical Relocations	79-C-0006	P G & E	359.7 (est.)	98	May 1980
Telephone Relocations	79-C-0029	P T & T	189.7	95	May 1980
Project Overlook	80-C-0027	Tyler-Engelke	598.3	0	January 1981

Legal Events – Warm Springs Dam and Lake Sonoma

Sequence of Legal Events — Warm Springs Dam and Lake Sonoma

Authorization: 1962 Flood Control Act. Construction initiated in 1967 with relocation portions of Stewart Point-Skaggs Springs Road and Rockpile Road include Warm Springs Bridge. Project lands acquisitions were essentially completed. When the Supreme Court injunction halted construction three contracts were terminated, Unit 2 of Stewart Point-Skaggs Springs Road, Partial Test Fill, Outlet Works. Outlet Works contract was just awarded but no work was accomplished. The Sequence of Events as of the Supreme Court injunction is as follows:

22 Mar 1974 — Warm Springs Task Force Suit to halt construction.*

30 May 1974 — Justice Douglas granted stay on construction.

11 Feb 1975 — Hearing on Appeal held.

19 Aug 1975 — Appellate Court remanded case to District Court for review of studies.

17 Sep 1976 — Final Supplement to EIS, filed with CEQ.

27 Jan 1977 — District Court ruled EIS and Supplement adequate — injunction lifted.

14 Jun 1977 — Warm Springs Task Force filed motion for injunction to halt construction pending Appeal.

14 Nov 1977 — Warm Springs Task Force filed a brief of Merits of Appeal.

23 Nov 1977 — Appellate Court denied injunction.

5 Dec 1977 — Warm Springs Task Force filed Petition for rehearing of Application for injunction pending Appeal.

5 Jan 1978 — Letter to OMB from State Resource Agency of California requesting delay in construction until State concerns are resolved.

*Warm Springs Dam Task Force, et. al. v. LTG William C. Gribble, Corps of Engineers, et al., Calif. Ninth Cir., Civil No. 77-2301. (Warm Springs Dam and Lake Sonoma). The Construction Site on the Warm Springs Dam and Lake Sonoma Project is located on Dry Creek, Russian River Basin, California. This suit, filed 22 March 1974, seeks to enjoin the Government from proceeding with the project. The plaintiffs allege violation of NEPA and the National Historic Preservation Act of 1966 (16 U.S.C. 470). The district court ruled in favor of the Corps, and the matter is still on appeal before the Ninth Circuit Court of Appeals. The Court of Appeals declined to issue a stay pending appeal, and construction contracts have been awarded. See 565 F. 2d 549 (9th Cir. 1977). On 25 May 1979, appellants filed an amended re-application for injunction pending appeal. On 30 May the U.S. Attorney filed a memorandum in opposition. The appellate court to date has not issued any opinion, either on the merits of the appeal or on the re-application for an injunction pending appeal. Construction is approximately 55% completed. (San Francisco District — 3 December 1979).

13 Jan 1978 — Petition for rehearing denied by Court of Appeals.

16 Jan 1978 — Letter to CE from Department of Conservation (Priscilla Grew) providing update on the review of the project.

17 Jan 1978 — Hearing on Merit of Appeal set for 15 March 1978.

27 Jan 1978 — Board of Consultants Meeting held at Project Office.

16 Feb 1978 — Letter to State Resources Agency of California — with the solution to their concerns.

17 Feb 1978 — Letter from State Resources Agency of California accepts solution.

17 Feb 1978 — Advance Notice for Bid on Dam and Appurtenant Facilities issued.

1Mar 1978 — Advertised for bids on Dam and Appurtenant Facilities.

15 Mar 1978 — Hearing on Merit of Appeal. No decision rendered.

2 May 1978 — Opened bids on Dam and Appurtenant Facilities. Apparent low bidder was Auburn Constructors at $118,746,490.

9 May 1978 — Warm Springs Task Force filed for renewed hearing of application for injunction pending Appeal.

11 May 1978 — Hearing on Application for injunction pending Appeal. No decision — However Corps agreed to postpone contract award until appeal decision on or about 24 May 1978.

25 May 1979 — Appellants filed amended re-application for injunction.

30 May 1979 — U.S. Attorney filed a memorandum in opposition.

Article by Ida Geary

Learning To Love The Corps
by Ida Geary

Mary McGrory, Washington political commentator, has said that "the Army Corps of Engineers...has never seen a river that didn't need a dam...."

The remark conveys the usual stereotype of the Corps of Engineers, and before I began teaching a course for them called Wetlands, Plants, and Birds, I too thought they were all "damn dam builders," as they often mockingly call themselves.

But at our very first Friday afternoon class, at the Fort Point Promenade classroom under the Golden Gate Bridge, where I teach plant identification for the San Francisco Community College in a National Park Service building, I began to learn about the Corps. That was five years ago, and I have just recently finished my seventh class with them — all on their working time — and I am still learning, and they still surprise me.

The first thing I learned is that the Corps is not monolithic. The people who work for it, mostly civilians, are not all alike, and they do not think alike. There is no typical Corps person, at least, not that I have seen. To the contrary, the Corps seems to include an unusually broad spectrum of people: women, blacks, Asians, Latins, and the young and free-thinking. In one class of fifteen the only bona fide, trained engineer was a woman — everyone else was from some other discipline.

Corps people can be marine biologists, sociologists, geologists, anthropologists, and more, I learned. Corps people can be even more concerned with the environment than you or I, I also learned. Being concerned with the environment is their job, they explained to me, despite all stereotypes to the contrary.

While driving back from a field trip, one engineer confided, "It isn't easy to change from being an engineer interested only in one aspect of the job, to being protector of the environment. But that's what we're charged to do now, and I'm learning to do it."

It is not generally known, but since 1975 the duties of the U.S. Army Corps of Engineers have been extended (under the Federal Water Pollution Control Act of 1972, called the Clean Water Act) to include the protection of America's wetlands from unnecessary despoliation. Once the Corps' jurisdiction was confined to navigable waters, but now, under the Clean Water Act, it regulates the discharge of dredged or fill material in just about all the waters of the United States. This extended area of authority includes tributaries of navigable rivers, lakes, streams, adjacent wetlands, even vernal pools (those that dry up in summer), and prairie potholes.

Often plants are an indication of wetlands: even when dikes are put in and the tidal flow cut off, the salt-marsh plants remain for a time, although not the salt marsh itself. If one finds three or four species of typical salt-marsh plants — cord grass, pickleweed, and salt grass, for instance — in an area near a bay or ocean, it may be an old salt marsh, even though dried out, and the Corps may still have jurisdiction over it.

Environmentalists were coming to the Corps and saying these salt-marsh plants prove that a certain area is an old salt marsh, and therefore, the Corps must regulate any landfill project proposed for it. Usually it is a developer proposing to fill, but sometimes it is a city—enlarging an airport, for instance—or a state agency. Please note that environmentalists are asking the Corps to take jurisdiction in these cases. They have learned, even if the general public has not, of the changing role of the Army engineers.

The Corps has traditionally called in experts, but it wanted its own people to be able to identify salt-marsh plants and salt marshes. So they asked me to help, and we set out together to learn salt-marsh plants, fresh-water plants, and eventually birds, since they too are an indication of the viability of a marsh.

Although some old-time Corps engineers were diffident at first about being mistaken for posy pickers or birdwatchers, many others in the Corps were plant and birdwatchers before they enrolled in the class. I would think of these particular engineers when environmentalists asked me if I were brainwashing the Corps as well as teaching it. I was never able to convince some conservationists that the Corps came to me and asked me to teach its personnel, who are just as enthusiastic about the natural world around us as any other group of students. Maybe even more so, because to some it was all very new.

So together we explored the many salt marshes in the San Francisco Bay Area, and together hunted out the few remaining fresh-water marshes we could find. I taught them how to press plants and make a professional herbarium on large sheets of heavy paper, or a study herbarium of ring notebook size. I took them to the botany department of the California Academy of Sciences, where they can take their questions in the future, and introduced them to the literature and field guides having to do with the local wetlands, plants, and birds.

And finally, as each Corps group finished the course of study, we had a graduation ceremony in the classroom, complete with diplomas and a picnic luncheon to which each graduate brought an ethnic dish, depending on his or her background. We had Chinese food, Japanese rice balls, Korean and Filipino delicacies, Jewish food, German, Scandinavian, Italian—they brought them all, highlighting their diversity of background and of thought. No one ever brought American cheese on white bread.

No, I was reminded again and again with the Army Corps, one cannot lump all the Engineers together in one class, as one group, thinking one thought. They are not all "damn dam builders," I now know, and I think that this lesson that I learned with them is as valuable as any that they learned with me.

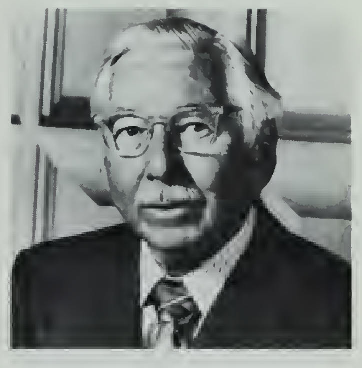
Source: *Country Journal*, August 1979.

Distinguished Employees

ISRAEL H. STEINBERG

After 40 years of exceptional and dedicated service to the Corps of Engineers, Mr. Steinberg retired in June 1973. During those years Mr. Steinberg became recognized both within his profession and by the public at large as one of the most innovative and competent employees in the Federal Government. His leadership in the San Francisco Bay Comprehensive Survey, Water Quality and Waste Control and use of hydraulic models led to an expansion of service to the public and State and local agencies by the entire Corps of Engineers.

PATRICK M. SULLIVAN



After 39 years of exceptional and dedicated service, Mr. Sullivan retired in 1974 from his position as Comptroller. He provided excellent leadership to the Comptroller organization enabling automation of the Finance & Accounting Revolving Fund System. Furthermore, he was instrumental in developing a large portion of the prototype system for the Corps of Engineers Management Information System (COEMIS). Mr. Sullivan's professional competence was an invaluable asset to the District Engineer and his staff in policy formulation and decision making.

WILLIAM A. ANGELONI

Mr. Angeloni's distinguished 38-year career was highlighted by his abilities first as a surveyor and engineer, later as a supervisor and manager and finally as the executive in charge of the leading Regional ADP Center for the Corps of Engineers. Numerous honors included being an engineer member of a three-man Air Force Academy Site Selection Team, member of the local Nike Missile Site Selection Team, and major contributor to the development of the Corps' Management Information System (COEMIS). Awards include the medal for Meritorious Civilian Service, commendation by the Chief of Engineers, numerous outstanding performance awards and honorary membership in the national American Congress of Surveying and Mapping (the 32nd member awarded this honor and the second Californian to receive this award). He retired in December 1973.

PAUL L. VREDENBURG

Mr. Vredenburg's leadership and engineering capabilities earned him a world-wide reputation in marine construction, dredging, and heavy construction. As Chief, Construction-Operations Division he was extraordinarily effective during the Crescent City Tidal Wave and Northern California Flood Diaster of 1964. His was a major and decisive role in the development of flood control and navigation projects in Northern California. He retired on 6 July 1970 after 34 years of service.

CARMA HOLLAND

Miss Holland completed 34 years of dedicated service before retiring 12 March 1971 with a record of achievement, both personal and official that was highly commendable. She began her career in the San Francisco District in April 1937 as a Junior Stenographer and progressed to responsible positions which culminated in her appointment as Chief of the Personnel Office in April 1969.

RUSSELL L. SOLOMON

After 37 years of outstanding Service with the Federal Government, Mr. Solomon retired in December 1973. As Chief, Procurement & Supply Division, he played a key role in accomplishing the construction contracting mission of the San Francisco District by fulfilling supply contract requirements and administering overseas procurement through his comprehensive knowledge of the requirements of his profession.

ANN C. GORDON

Ann Gordon received her probationary appointment in July 1940 as a senior typist and was assigned to the Supply Division. During her thirty years of Government service she progressed to the Chief, Purchase Section where she was responsible for many important procurements for military establishment in the Pacific and Far East under the military supply program.

FRANK C. MORELLO

During a career spanning 33 years in the Construction Operations Branch of the San Francisco District, Frank Morello has gained the reputation for leadership, integrity and devotion to duty. Under Mr. Morello's leadership during the flood emergencies of 1964 the District received many commendations. He retired on 31 October 1969.

HARLAN B. WATKINS

His civilian service included positions as inspector, surveyor, junior engineer, assistant engineer, and real estate officer with the Los Angeles District and the South Pacific Division office. During the period 1940 thru 1946, Mr. Watkins served on military active duty being promoted to the rank of Colonel. In 1948, he transferred to the San Francisco District and served as Chief of Real Estate Division and later executive assistant to the District Engineer. Mr. Watkins retired on 24 October 1969 after 30 years of service.

EDWARD A. SCHULTZ

Mr. Edward Schultz, an innovative leader in the field of hydraulic modeling, gained both national and international recognition for his concept and creation of the Bay-Delta Model in Sausalito and for his service on the tidal hydraulic committee. His death in 1973, after 38 years of dedicated service, was a loss felt by the entire San Francisco District.

OSWALD J. PIETSCH

From his employment as Junior Engineering aide in August 1940 Mr. Pietsch rose to the responsible position of Assistant Chief, Project Planning Branch, the capacity in which he served until his retirement in September 1970. He was the planning engineer responsible for conducting the survey report investigations which led to the authorization of Warm Springs Dam.

GEORGE P. REILLY

As Chief of the Engineering Division for 11 years, Mr. Reilly was a forerunner of environmental awareness in water resources engineering. He directed the implementation of environmental design considerations in projects such as Corte Madera Creek and Alameda Creek and encouraged both the scientific and public education uses of the Bay Model. After 38 years of service he retired in February 1972.

EVELYN C. NORMAN

Her 37 years of dedicated service in the Corps of Engineers commenced as Junior Clerk in the St. Louis District in 1929. Subsequently, she served in the District Engineer Offices in Vicksburg, Memphis, Los Angeles, and San Francisco. In the latter office, Mrs. Norman was Personnel Officer from 1941 until her retirment on 30 December 1966.

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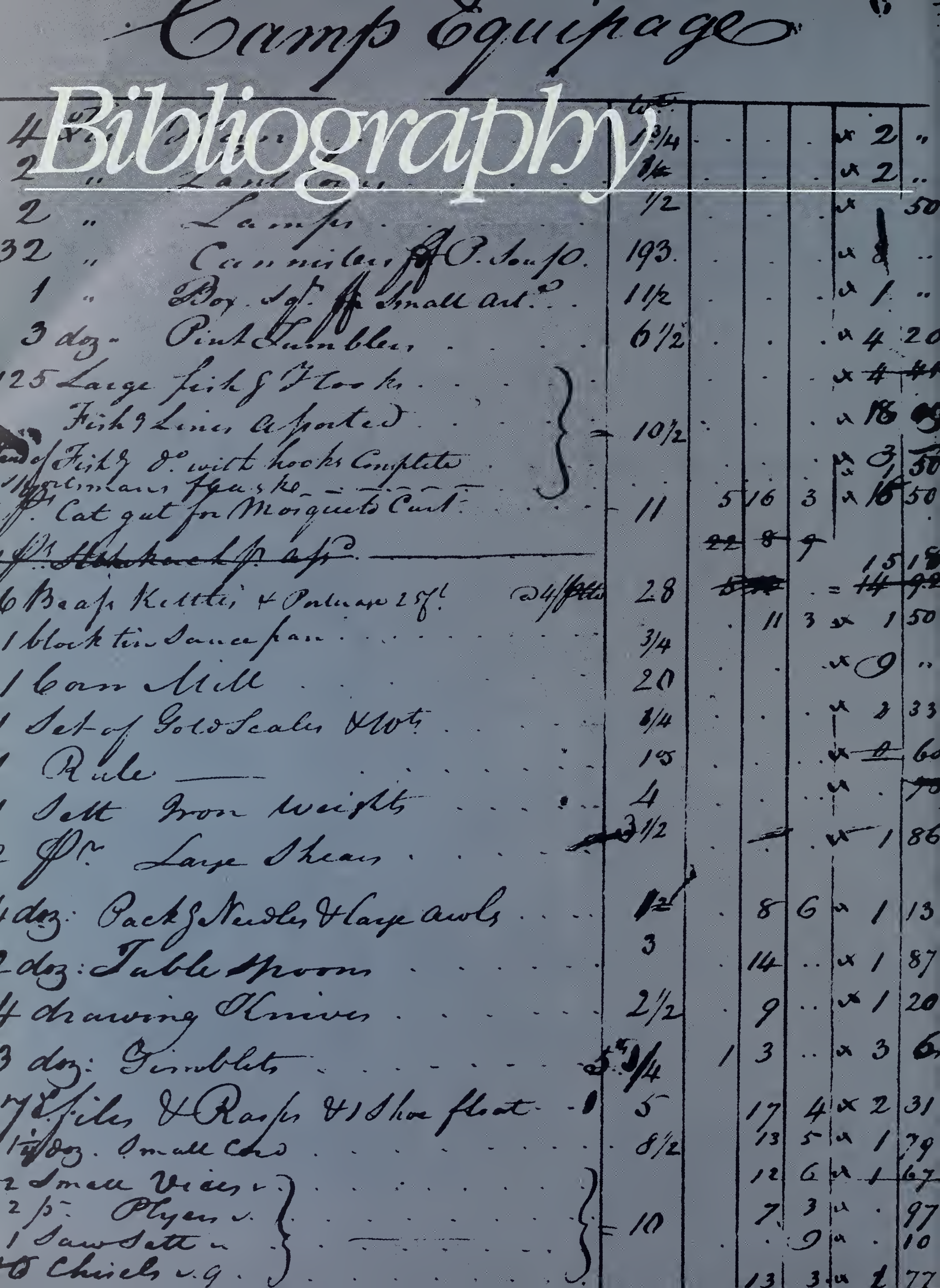

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83	Time Rolls of Employees, July 1853-Dec. 1864.
84	Vouchers Paid, Quarterly Returns, and Accounts Current of Lt. Col. R. E. De Russy, 1855.
84	Register of Materials Received, 1858-1863.

3. SUBORDINATE OFFICE: FORT WINFIELD SCOTT, CALIFORNIA, 1902-1907.

85	Letters and Other Papers Received at Fort Winfield Scott, Calif. by Supervising Engineer F. C. Deacon, 1902-1906.
85	Press Copies of Letters and Reports of Operations Sent by Engineer Office, Fort Winfield Scott, California, Oct. 1904-May 1907.

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	Forts 602 Tennessee Point General plans and index
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	Fort Cronkhite AA battery Rd. Computations & estimate Jan.-Mar. 1938

Triangulation — Fort Cronkhite — Anti-Aircraft Guns. Nov. 1939

Proceedings of Board of Officers convened at Presidio of San Francisco March 27, 1939, 3″ anti-aircraft gun project.

Specifications — Battery Townsley, Fort Cronkhite, Calif. May 1938-1940

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Photographs of Wolf Ridge, Coyote Ridge, etc.

Road layout — Tenn. Point Feb. 1935

Fort Cronkhite. Protective concealment — roadway extensions Oct. 1939

Box 45 (old series 1909) Fort Cronkhite roadway — Rodeo Lagoon to Hill 417 Oct. 1939

Fort Cronkhite computations — road extensions to Wolf Ridge Road Nov. 1939

Fort Cronkhite specifications & drawings roadway construction May 1939

Fort Cronkhite — computations for Lagoon roadway Aug. & Oct. 1939

Construction program — general engineering features, etc. (Fort Funston)

Naming of new 16″ battery at Fort Funston Dec. 1937

Fort Funston specifications for 16″ guns

602 Fort Funston #1 16″ gun battery

Box 46 (old series 1909) Fort Funston — Specifications for construction of gun blocks for 155 mm gun battery

Foundation studies and computations for Battery Davis, Fort Funston, 1938

Fort Funston, Battery Davis Central Traverse Magazine May 1938

Box 47 (old series 1909) 606 Fort Funston #6 Battery Davis Casemate plans & specifications June 1938

Fort Funston studies and design data for casemate 1938

Report of foundation development for casemates Battery Richmond P. Davis. Fort Funston, Calif. Dec. 6, 1938

	155 and AA battery Fort Funston specifications. AA Fort Scott 1937
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	Yerba Buena roadway — 2nd const. check calculations, 1937
	Yerba Buena Island specifications — water supply, roadway 1936.
	Report of completed works (Fort Miley) Dec. 1910-Dec. 1929
Box 50 (old series 1909)	Correspondence, drawings, and fortifications — San Pedro Harbor, 1908
(old series 1911)	Steamer *General Alexander*, 1906-1915
Box 51 (old series 1913)	Complete project for the land defense in the Artillery District of San Francisco (1909) and supplementary project for the land defense by the Coast Guard in the Artillery District of San Francisco (1912)
	Land defense projects and initial steps toward final revision May 1915
(old series 1908)	Correspondence relative to land defense projects 1907-Jan 31, 1912
	Revision project for land defenses of Coast Artillery Supports, Fort Miley, Calif., 1918-1919

Project Construction Files, 1913-1938

Box 52 (NA 1855)	Photographs: 1913-1925 1. San Francisco 2. Oakland Harbor

	3. San Pablo Bay 4. Suisun Bay & SLH including Carquinez Strait
Box 53 (NA 1855)	Photographs: 1915-1927 5. Humboldt Bay & Jetties 6. Monterey Bay 7. Richardson Bay 8. Crescent City Wooleyport Harbor Noyo River
Box 54 (NA 1855)	Photographs: 1922-1925 9. Richmond Harbor 10. Trinidad harbor 51A Mare Island Strait 52. Petaluma River 56. Corte Madera Creek 59. Klamath River
(NA 2856)	Photographs: 1936-1937 Yerba Buena Shoals Project
Box 55 (NA 1856)	Photographs — Yerba Buena Shoals Project, 1936-1938
Box 56 (NA 1856)	Prints & negatives — Yerba Buena Shoals Project, 1936-1938
Box 57 (NA 1856)	Negatives — Yerba Buena Shoals Project, 1936-1938
Box 58 (old series 1914)	Operation and Maintenance Files, 1853-1941 Press copies of reports of operations received from subordinate engineers re fortifications Sept. 1896-Feb. 1902 2 vols.
Box 59 (old series 1915)	Journal of operations pertaining to fortifications on Alcatraz Island 2 vols.
Box 60 (old series 1916)	Journal of operations pertaining to the fort at Lime Point, CA
Box 61 (NA 1857)	Annual power survey report. Power district no. 12. 1941. (4 parts)
Box 62 (old series 1917 & 1918)	

Fiscal Records, 1906-1928

Ledger of disbursements ("cash book") under various appropriations, 1906-1920 3 vols.

Ledger of disbursements ("cash book") under various appropriations in the River & Harbor Office 1911-1928 (7 vols.)

Box 63 (old series 1919)

Personnel Records, 1862-1886

Returns of officers and hired men at fort on Alcatraz Island, CA. 1862-1886 1 vol.

Box 64 (old series 1920)

Property Records, 1854-1861

Register of materials and services received & their cost for fortifications at Alcatraz Island San Francisco Bay 1854-1861 1 vol.

Box 65 (NA 1857) — Engineering Studies 1897-1946

A. Storm Studies 1904-1945

Box 66 (NA 1857) — 000.92 Storm studies (general and correspondence 1938-1940)

Box 66 (continued) — 000.92 Storm studies (general and correspondence 1940-1943)

000.92 Storm studies, correspondence, 1943-1945

000.92 Storm Studies. Correspondence 1943-1945

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Berkeley Airport Wind data March-Oct. 1945, Jan.-Feb. 1946

Wind & waves climatological data files 1929-1931. Berkeley Pier & Mare Island.

Wind charts. Humboldt Bay 1924

Wind charts. San Francisco Bay

Wind data, 1920-1929. San Francisco

Box 67 (NA 1858) — Mass rainfall curves for Dec. 28, 1913

SP3-7 Storm #5 1913-1914

SP3-8 Storm #6 Jan. 1-28, 1914

SP3-14 Storm #7 Jan. 27-Feb. 8, 1926

SP3-18 Storm #8 Jan. 1-18, 1936

SP3-2 3 4 Storm #9 Feb. 1-9, 10-17, 18-29, 1904

SP3-4 & 5 Storm #10 March 1-12, 13-25, 26-31, 1904

SP3-11 Storm #11 Jan. 16-Feb. 6, 1921

SP3-20 Storm #12 Nov. 5-25, 1937

SP3-13 Storm #13 Feb. 1-9, 10-15, 1925

SP3-1 Storm #14 Jan. 23-Feb. 9, 1897

SP3-17, 3-12 Cancelled Storms; Storm No. 7-1930, Dec. 31-Jan. 3; No. 14 — 1921, Feb. 19-20

SP2-13 Check sheets. Storm of Jan. 19-24, 1943

SP2-13 Storm of Jan. 19-24, 1943. Rainfall stations

Precipitation data Jan. 22-27, 1912

SP3-9 Jan.-Feb. 1915 (divider)

Administration of revision of storm study. Jan.-Feb. 1915 SP3-9

Synoptic charts — hydrologic. Jan.-Feb. 1915 SP3-9

Work sheets. Revision of storm SP3-9 Jan.-Feb. 1915

Synoptic charts — meteorological storm SP3-9 Jan.-Feb. 1915

Alaska & Hawaii observations. Storm SP3-9 Jan.-Feb. 1915

Frontal phenomena at first-order weather bureau stations SP3-9 storm

Adjusting sheets

Meteorological synoptic charts SP3-9 storm

Intensity-duration data at various stations 1906-1939

Storm of March 22-23, 1907 — Northern California — isochronal lines

Lists of maximum flood flows, 1904-1939

Box 68 (NA 1858) B. Special Precipitation Reports, 1897-1946

Correspondence and notes re rain gaging project, 1939-1940

Rainfall station data. Eel River, 1939-1941

Klamath Basin — general 1939

Rainfall stations. Lower Klamath Basin. 1943-1944

Rainfall Station Data. Napa

Rainfall Station Data. Pajaro River

Rainfall Station Data. Russian River

Rainfall Station Data. Salinas River Basin

Runoff Studies, 1879-1944 Calculation of normal seasonal runoff from ratios, 1900-1941

Normal seasonal runoff calculations for base stations, 1902-1941

Ratios of seasonal runoff—Eel at Scotia as base 1905-1941

Ratios of seasonal runoff—Putah near Winter as base 1928-1940

Ratios of seasonal runoff—Arroyo Seco at Soledad as base, 1905-1907, 1932-1940

Double mass & ratio curves, 1880-1941

Seasonal rainfall for individual stations—cumulative subtotals 1849-1940

Seasonal rainfall figures. Statistical operations 1879-1941

Calculation of normal seasonal rainfall—method of least squares 1879-1941

Normal seasonal precipitation studies—ten station base, 1879-1941

Experimental double mass curves—various bases, 1944

Flood discharge at major streams. Report due 6/1/39

Pertinent data sheets. Storm studies. 1941

Private rainfall stations. Storms studies: rain gages & record correspondence to Dec. 1942

Storm studies: rain gages & record correspondence—1943

Storm studies: rain gages & record correspondence—1944

Storm studies: rain gages & record correspondence—1945

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Box 69 (NA 1858) Precipitation records.

"Interim report on the assignment and activities of the storm studies project San Francisco Engineer District." August 1, 1942

Index of records in file

"Inclosure to Supplement C of the Storm Studies Directive Entitled," Part II, Report on Storm of July 22-27, 1933 (LMV 2-26) Near Northwestern Louisiana. Illustrative of the Manner in Which Computations of Phase II of Storm Studies Are To Be Made"

Storms studies. Period of record shown for all stations in S.F. District

Data from double mass curves for seasonal isohyetal map, 1961-1945

Index of rainfall records in Book III of Maps

Index of rainfall records in Book IV of Maps

Book I List of stations, period of record, seasonal records copied

Book II Stations with records to be copied

Box 70 (NA 1859) Precipitation station index. South Pacific Division. To accompany map no. 373/1. U.S. Engineer Office. Los Angeles, California.

California stations on isohyetal plotting maps and private rainfall stations. (2 copies)

Locations & histories of private stations having records at D.W.R.

Precipitation gaging stations in California & Oregon near California

Fire weather indices

Lists of U.S.E.D. stations & observers. 1940 precipitation studies.

Rainfall stations — San Francisco Dist. 1943

Locations of runoff gaging stations

Index to river gaging stations. 1940

Stream gaging stations — descriptions.

Areas of primary interest

Gage establishment by forest service. 1943

	Records of heavy precipitation at various stations and lists of major storms
	Storm #1 Dec. 9-12, 1937
	Altitude precipitation study No. 1-4. 1937 storm
Box 71 (NA 1859)	Storm #4
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(NA 1860a)	Hourly precipitation at continuous recording stations and daily precipitation at weather bureau stations. Storm of Dec. 9-12, 1937
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Box 75 (NA 1860)	Storm study — phase 1. Jan. 24-Feb. 26, 1915. Vol. I Basic data sheets.
	Storm study — phase 1. Jan. 24-Feb. 26, 1915. Vol. II Mass curve sheets.
Box 76 (NA 1860)	Storm study — phase 1. Jan. 24-Feb. 26, 1915. Vol. III Mass curve sheets Feb. 6-11.
	Storm study — phase 1. Jan. 24-Feb. 26, 1915. Vol. IV Mass curve sheets Feb. 15-26.
	Mass curves of storm of January and February 1915. Part I — Jan. 24 to Feb. 4. California, Nevada and Oregon.
	Mass curves of storm of January and February 1915. Part II — February 6 to 11. California, Nevada and Oregon.

	Mass curves. Storm of January and February 1915.
Box 77 (NA 1860)	Basic rainfall data. Storm of January and February 1915. California, Nevada and Oregon. Vol. I.
	Basic rainfall data. Storm of February 16-27, 1917. California, Nevada and Oregon. Vol. I.
	Mass rainfall curves. Storm of Feb. 16-27, 1917.
	Storm study. Part I of study of storm of December 28, 1913 to January 4, 1914.
	Daily precipitation at weather bureau and private stations and mass curves. Storm of December 9-12, 1937. California and Oregon. Vol. II
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	Rain gage stations plotted on mass rainfall survey. 1938—Jan. 26 to Feb. 16.
	Precipitation data: non-recording stations. Jan. 5, 1935 to March 26, 1924.
Box 79	Historical Photograph File (Cecilia Le Beouf)
	Misc. photographs and newspaper articles
	Periodicals and pamphlets
	Liaaen-Wegner controllable pitch propeller installation. Sea-going Hopper Dredge "Chester Harding"
	Photographs of dredging at Yerba Buena Island, 1936
	Photographs—Rock removal of San Francisco Harbor (1930s)
	Tidal wave report and photographs, April 1946
	Dredging
	Port of Oakland
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	San Francisco Bay, Richmond—San Rafael Bridge
	Yerba Buena Shoal fill
	San Francisco Bay (Work on Commission Rock)

San Francisco Bay. Soil erosion

San Francisco Bay. (Misc. photos & negs.)

San Francisco Bay. Debris

San Francisco Bay. Bridges

San Francisco Bay. Albany dump

San Francisco Bay. Sausalito Base Yard

2. SUBORDINATE OFFICE: FORT POINT, CA. 1853-64; 1896-1902

Box 80	Correspondence, 1858-1864; 1896-1902
(old series 1921)	Letters Sent. July 1858-Feb. 1861. 1 vol.
(old series 1922)	Letters Sent by Engineer officers Gilmer and De Russy relating to fortifications. Jan. 1861-Dec. 1864. 1 vol.
(old series 1923)	Letters received by the Supervising Engineer. 1896-1902. 1 vol.
	Operations, 1854-1864
Box 81 (old series 1924)	Daily report of operations. April 1854-Aug. 1864. Vols. 1 & 4
Box 82 (old series 1924)	Daily report of operations. April 1854-Aug. 1864. Vols. 2 & 3.
	Personnel Records, 1853-1864
Box 83 (old series 1925)	Time rolls of employees. July 1853-Dec. 1864. 3 vols.
	Fiscal Records, 1855; 1858-63
Box 84 (old series 1926)	Vouchers paid, quarterly returns, and accounts current of Lt. Col. R. E. De Russy, 1855
(old series 1927)	Register of materials received. 1858-63 1 vol.

3. SUBORDINATE OFFICE: FORT WINFIELD SCOTT, CA 1902-07

	Correspondence Received, 1902-1907
Box 85 (old series 1912)	Letters and other papers received at Fort Winfield Scott, CA., by Supervising Engineer F. C. Deacon. 1902-1906 1 vol.

(old series 1912a)	Press copies of letters and reports of operations sent by Engineers Office. Oct. 1904-May 1907 1 vol.

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Steinberg, I.H. — Remarks by Mr. I.H. Steinberg, Chief, Project Planning Branch, U.S. Army Engineer District, San Francisco, before the Little Lake Water District on June 11, 1968.

Letters to the Author From:	Date Received
1. Angeloni, William A. (SFD Retired)	August 4, 1978 November 22, 1978
2. Dutra, Edward A., Chairman of the Board, Dutra Dredging Company	September 17, 1979
3. Fox, James A. (SFD Retired)	August 7, 1978
4. Greenwood, Dr. John T. Chief, Historical Division, Office of the Chief of Engineers	January 8, 1979
5. Kiramidjian, Ludwig (SFD Retired)	March 3, 1979
6. Pietsch, Fr. Oswald (SFD Retired)	July 25, 1978 September 28, 1978

Interviews

Employees of the San Francisco District, U.S. Army Corps of Engineers.

1. Angeloni, William — Chief, Operations Branch
2. Boyle, Walter — Chief, EPA Grants Branch
3. Dickson, William — Chief, Waterways Maintenance Section, Operations Branch
4. Dunn, Gene — Chief, Civil Design Branch
5. Farless, Jack — Acting Chief, Construction/Operations Division
6. Fong, Calvin — Chief, Regulatory Functions Branch
7. Green, Roger — Attorney, Office of Counsel
8. Pape, Henry — Chief, Engineering Division
9. Riddle, Robert — Acting Chief, Engineering Division
10. Scarpace, Frank — Comptroller
11. Trail, Gerry — Chief, Program Planning Branch
12. Visage, James — Acting Chief, Program Development Office
13. Wolfe, James — Acting Chief, Engineering Division

District Engineers San Francisco District

NAME & RANK	YEARS
Maj. Robert S. Williamson	1866-1871
Maj. George H. Mendell	1871-1895
Capt. Joseph E. Kuhn	1895-1896
Col. Charles R. Suter	1896-1901
Col. William H. Heuer	1901-1907
Lt. Col. John Biddle	1907-1911
Col. Thomas H. Rees	1911-1917
Col. William H. Heuer	1917-1919
Col. Charles L. Potter	1919-1920
Col. Herbert Deakyne	1920-1925
Maj. John W. N. Schulz	1925-1927
Col. T. H. Jackson	1927-1928
Maj. E. H. Ropes	1928-1931
Lt. Col. H. A. Finch	1931-1935
Lt. Col. J. A. Dorst	1935-1939
Maj. R. C. Hunter	1939-1940
Col. K. M. Moore	1940-1941
Col. E. M. George	1941-1942
Col. James D. Andrews, Jr.	1942-1944
Col. K. M. Moore	1944-1945
Lt. Col. Harold E. George	1945-1946
Col. George Mayo	1946-1947
Col. S. N. Karrick	1947-1949
Col. Fremont S. Tandy	1949-1950
Col. K. M. Moore	1950-1952
Col. Henry Walsh	1952-1953
Col. A. J. Goodpaster	1953-1954
Col. W. F. Cassidy	1954-1954
Col. John A. Graf	1954-1957
Col. John S. Harnett	1957-1960
Col. John A. Morrison	1960-1963
Col. Robert H. Allan	1963-1966
Col. Frank C. Boerger	1966-1969
Col. Charles R. Roberts	1969-1972
Col. James L. Lammie	1972-1974
Col. Henry A. Flertzheim, Jr.	1974-1977
Col. John Miley Adsit	1977-1980
Col. Paul Bazilwich, Jr.	1980-

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Photography Acknowledgments

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Presidio Library, Sixth U.S. Army, Presidio of San Francisco

National Maritime Museum, San Francisco

California Department of Parks and Recreation, Sacramento

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